Chemical Engineering A MCGRAW-HILL PUBLICATION

OCTOBER 19, 1959

Published every-other-Monday

Seventy-five cents

heat exchange lowers cost of

HEAVY WATER

EIMCOBELT.

The Eimco Corporation is proud to announce the EimcoBelt filter . . . an important achievement in the science of liquid-solids separation through continuous vacuum filtration.

EimcoBelt is a perfected continuous belt drum filter. It was developed in Eimco's Research and Development Center at Palatine, Illinois, in cooperation with Eimco design engineers at the factory, who worked for more than six years with a budget of over a million dollars to create, field test, and perfect this revolutionary new filter.

The EimcoBelt, equipped with cloth or metallic medium, eliminates blinding. The medium is removed from the drum every filter cycle for cake discharge and cloth cleaning.

- Thin cakes are easily discharged.
- High vacuums, and high cake washing efficiencies, are maintained.
- Capacities are greatly increased, permitting, in many cases, the use of smaller filters for the required tonnage.
- Slurries with low density solids, which ordinarily require thickening, can be filtered, and thickening retention time eliminated.
- Cloth change can be accomplished in less than 30 minutes.

If you use filtration in any of your processing, let us show you the advantages of the EimcoBelt. Write for Bulletin F - 2053.

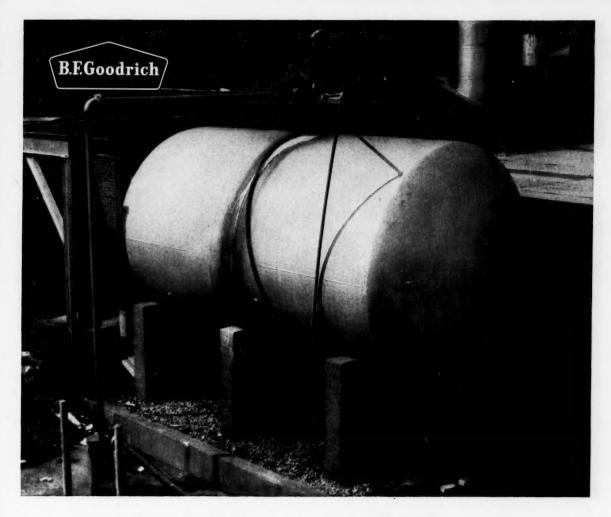
THE EIMCO CORPORATION



FILTER DIVISION

434 SOUTH 4TH WEST

HESEARCH AND DEVELOPMENT CHITES 301 SO. HICKS ROAD, PALATINE, ILLIMOS



How Koroseal saves \$12,000 a year for L. A. Darling Company

THE L. A. Darling Company of Bronson, Michigan manufactures plated racks and other display equipment for retail stores. Manual handling of muriatic acid in carboys (glass containers) was an expensive part of the manufacturing cost.

Then, three years ago, Darling installed a 12,000-gallon Koroseal-lined tank (pictured above) and a network of rigid Koroseal PVC piping. The tank permitted bulk purchase of acid, and the piping eliminated manual handling. Tangible savings have been in excess of \$12,000 each year. And further sav-

ings have been realized through the elimination of broken carboys and the release of working capital previously tied up in deposits on carboys.

Koroseal rigid PVC by B.F. Goodrich has answered countless problems for alert manufacturers. Koroseal is unaffected by most alkalies and acids and is completely inert in the presence of oil, alcohol and salt solutions. It resists corrosion, has superior insulation qualities, will not support combustion and never needs to be painted.

Easy to install, Koroseal in various forms can be threaded, cut, welded

or drilled. It is available in pipe, tubes, rods, valves and sheets. For information, just send in the coupon.

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□R	igid Koroseal Pipe igid Koroseal Sheet
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Name Company	
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B.F.Goodrich Koroseal rigid PVC products

THIS KIND OF FILTER HARD TO MAINTAIN?

DON'T YOU BELIEVE IT!



You don't have to be told that nothing can touch the tilting pan, horizontal, vacuum filter when it comes to counter-current washing.

You also know how easy it is to operate, and to keep running at peak effectiveness. But, what about maintenance? Is this kind of filter costly to keep up?

NOT IF IT'S A BIRD-PRAYON! Here's why:

- With the Bird-Prayon Filter the feed simply drops on — the washed cake drops off. No mechanical discharge is employed. There's no need for it.
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- 3. The Bird-Prayon can be fully lubricated while in operation.
- 4. The Bird-Prayon employs cone-shaped rollers to eliminate wear.
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For detailed recommendations, layouts and estimates get in touch with our nearest office.

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October 19, 1959 Chemical Engineering Vol. 66, No. 21

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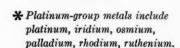
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HOW HERCULES HELPS...



PACKAGE GLAMOUR TO PERFECTION—Pro-fax®, Hercules polypropylene, does it in this striking new aerosol container for Coty Spray Cologne. Called Petite Mist, it's available in four enchanting fragrances, in a choice of two eye-catching color combinations... either jet black or snow white, richly decorated with

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—Particle board used as core stock in kitchen cabinets and plywood partitions as well as for floor underlayment relies on Paracol®. This Hercules wax emulsion adds water resistance and increases dimensional stability of the board. Paracol treated board has less tendency to warp, can be sawed more readily, holds nails firmly.

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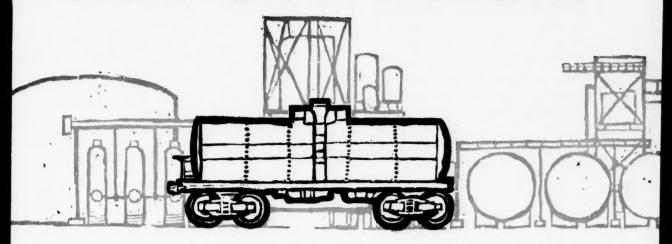
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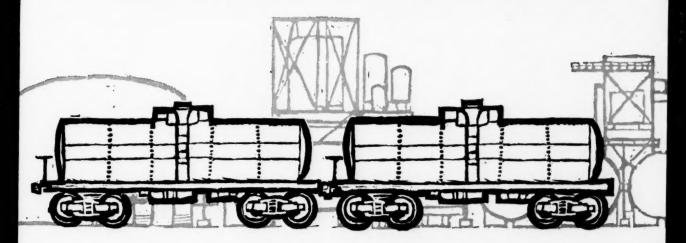
CHEMICAL MATERIALS FOR INDUSTRY



plan now to POWER-UP FOR PROFIT ELECTRICALLY



Olin Mathieson did and doubled production



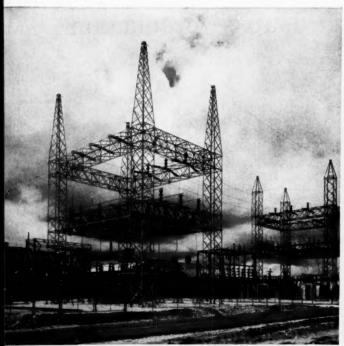
Olin Mathieson doubled production and reduced overhead at their Chlor-Alkali Plant in McIntosh, Alabama. Engineered and constructed by the Blaw-Knox Company, capacity was doubled at a cost of only two-thirds the initial investment.

If you want more capacity to meet the doubled production required by 1965, your Westinghouse representative can help you with a practical solution.

YOU CAN BE SURE ... IF IT'S Westinghouse

here's how Olin Mathieson

Olin Mathieson Chemical Corporation's Chlor-Alkali Plant built by Blaw-Knox Company at McIntosh, Ala.



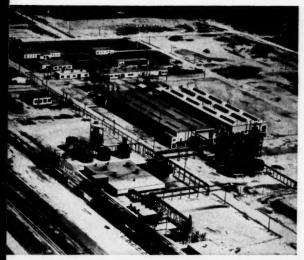
Twin modern substations equipped with Westinghouse metal-clad switchgear provide superior circuit protection. Fast and positive arc interruption is assured.



High mechanical and dielectric strength are two of many plus benefits of the design used in these Westinghouse transformers.

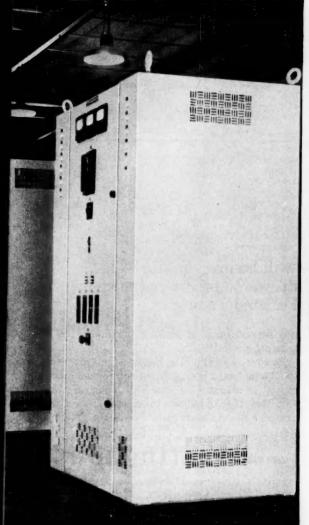
These Westinghouse rectifier auxiliary control cubicles provide smooth, fast variation in output voltage for the exacting demands of electrochemical processing. Here, under constant full capacity load, Westinghouse rectifiers have proved their ability to perform efficiently and with a minimum of maintenance.

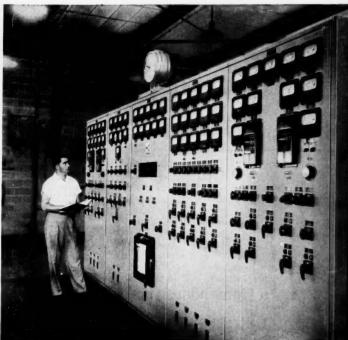
POWERED-UP with Westinghouse



Blaw-Knox, the general contractor, had future expansion in mind when planning started on Olin Mathieson's Chlor-Alkali Plant to be built in McIntosh, Alabama. They determined the electric energy requirements. Then, Westinghouse engineers worked out the most efficient and economical equipment and control to meet these specifications. Westinghouse, Blaw-Knox and Olin Mathieson, working together, decided on certain oversized equipment in anticipation of future needs. This planning paid off. In 1957, capacity was doubled at a cost of \$8,000,000 as compared to the initial investment of \$12,000,000.

The present daily consumption of electrical energy at this plant is 1,000,000 kilowatthours—equal to the power requirements of a city with a population of 300,000.





This custom designed duplex switchboard installation controls and supervises the electrical circuits. Walk-in cubicle construction makes maintenance easy with equipment protected yet readily accessible. Uniform appearance of all instrument and relay Flexitest* cases gives unit clean, modern appearance.

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here's why you should plan now to POWER-UP FOR PROFIT ELECTRICALLY

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	59 BILLION KWH	81 BILLION KWH	139 BILLION KWH	
	1958	1963	1968	

To stay competitive, you will be investing in a tremendous increase in electrically powered processing machinery. Be sure it is engineered to produce profits.

Power-Up is a Westinghouse program to help you increase profits through greater productivity. In your plant it may be a materials handling system, higher capacity machinery, or a more productive environment through higher lighting levels and air conditioning. One thing is certain—whether or not you earn satisfactory profits in the '60s

will depend on your making maximum use of low-cost kilowatthours.

Be sure—like Olin Mathieson—that your electrical equipment is engineered to produce profits as well as output. Call your Westinghouse representative. He can tell you the electrical steps you can take *now* to start your Power-Up program.

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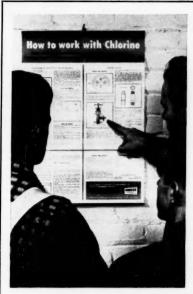
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- a grease that's applicable up to 200°
 C. (with an oil base stable to 300°C.)
- a grease that is odorless and nontoxic?

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It's a high-density polymer of trifluorovinyl chloride. It's available in many grades, ranging from low-viscosity, colorless oils to opaque greases.

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Thanks to an unusually careful flaking-screening operation, the Hooker flake stands shipping well—won't dust. It's available in two grades: U.S.P. grade is over 99% pure, contains a max of 0.2% benzoic acid.

tains a max. of 0.2% benzoic acid, 0.5% water.

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For more	information on	chemicals discussed	above, check here:

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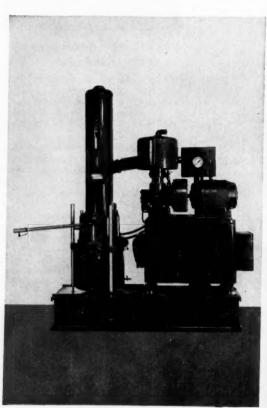
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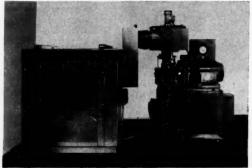
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NITROGEN GENERATOR — Comprised of a Model A Cryogenerator acting as a nitrogen condenser and an atmospheric pressure separation column. Rate of production is 6 liters per hour over an uninterrupted period up to 200 hours.



AIR LIQUEFIER — This unit liquefies air at atmospheric pressure — thereby insuring a contaminant-free product. Rate of production is 7½ liters per hour.



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GAS SEPARATION
AIR SEPARATION
CONVERSION OF GASEOUS O2 and
N2 TO LIQUID PRODUCT
METAL TREATMENT
COLD CHAMBERS
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LIQUID NITROGEN PRODUCTION
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COLD MACHINING
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"Packaged" units consisting of a Model A Cryogenerator with special headers or accessory equipment are also available.



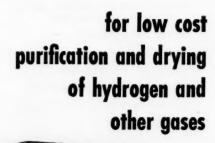
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Hanovia utility model
quartz lamp for preliminary
determination
of photochemical reactions



platinum clad sheet, tubing and wire for low cost corrosion-resistant equipment

Platinum clad sheet tubing and wire make it possible to incorporate all the important corrosion resistant qualities of the noble metals in equipment, at minimum cost. Platinum clad is pure platinum or an alloy of platinum so securely bonded to a base metal body that the composite metal can be fabricated. The gauge of the platinum metal can be specified to requirements. The process guarantees continuous pin-hole-free platinum cladding to withstand high temperatures without oxidation.

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Remove from carton and Metal-On is ready to install. Just snap on pipe and lock in place.



...the specially designed aluminum "snap strap" (containing vapor seal) is snapped on joint ...



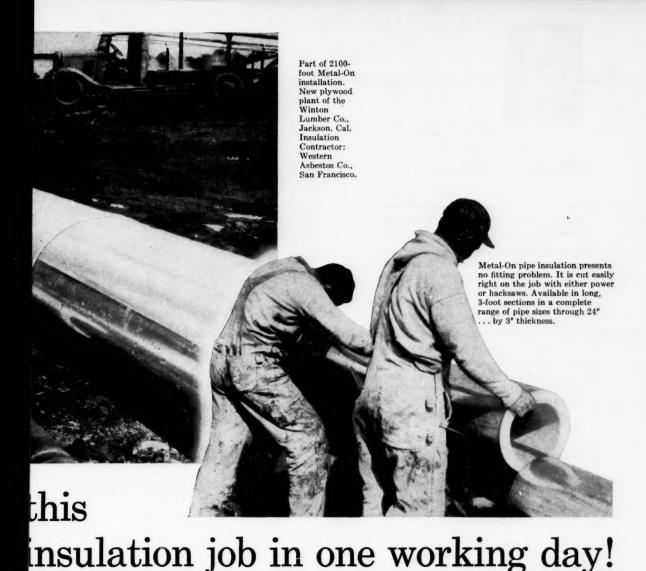
. . . Metal band completes the assembly. . . provides perfect joint protection against vapor and weather. Available in many colors, the Metal-On band also serves color coding purposes.

Two men completed 660' Metal-On

New Johns-Manville Metal-On insulation is today's fastest and most efficient way to install hightemperature pipe insulation...and protective metal jacketing

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JOHNS-MANVILLE





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"The profit derived from a process is directly dependent on the efficiency of the processing equipment. Here, at De Laval, we specialize in bringing maximum efficiency to the chemical processor.

"We go at it with a triple punch: an outstanding engineering staff; the most complete processing pilot plant in the country; and a full line of efficiency-engineered process equipment.

"The case of the detergent manufacturer cited in this advertisement is an example of our work in helping processors develop profitable processing operations. Without the specified, high efficiency centrifuge, this process might well have proved impractical because of the production costs.

"Why not let us devote our facilities and engineering talent to your problems. Just drop us a line on your letterhead describing your process. We'll be glad to recommend ways to increase your processing efficiencies. And, of course, there is no obligation to you."

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Dept. C-5

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THREE SOLVED WITH



T D M* classification of silica increased plant production 100%

Problem: To accurately classify five grades of silica as the last processing step before packaging and warehousing. Bottlenecking at this point had cut plant production.

Solution: A system of De Laval Syncro-Matic Separators with TDM Control. On leaving the dryer, silica was fed to the Primary screening unit which handled 11.3 tons per hour at efficiencies of better than 95%. The Secondary screener picked up the balance of the silica, handling 4 tons per hour, also at efficiencies of better than 95% on each grade. By using De Laval Syncro-Matic Separators with TDM Control in this application, plant production was increased a full 100%.

*T D M . . . three directional motion control. The Syncro-Matic has motion controlled in all three directions . . . horizontal, vertical and gyratory. It's the secret of the unit's outstanding efficiencies, and it is also responsible for the far greater throughput possible with the machine.

Available in carbon or stainless steel, the Syncro-Matic may be obtained with from one to three decks, and a full range of screen meshes and materials. Operation of the unit is exceptionally quiet.

For further information about this versatile new screen separator, just drop us a line on your letterhead. No obligation, of course.

Downtime for cleaning cut over-all efficiencies in Shell & Tube shellac cooling

In refining shellac to remove wax (a valuable by-product), the solution of shellac and soda ash must be heated to 200°F. After the wax is removed, the solution must be cooled rapidly. The processor had been using a Shell & Tube exchanger, but down-time for cleaning, and a series of cloggings and leakages had made serious cuts in processing efficiency.

Problem: To cool 13,500 lbs. per hour of the shellac/soda ash solution from 200°F. to 70°F. The efficiency of the

operation is of prime importance because the processor does not have an abundant water supply.

Solution: A single section De Laval P-12 Plate Heat Exchanger. The unit requires only 12,600 lbs. per hour of 60°F. water and maintains a temperature differential of 10°F. The plate heat exchanger cools the shellac/soda ash solution both rapidly and with the most efficient use of the available water supply.

The ease of cleaning the De Laval Plate Heat Exchanger is important to the processor, too. The plate pack is easily opened, immediately exposing all heat transfer surfaces for thorough, rapid, manual cleaning. Constructed of stainless steel throughout, it is easier to clean and eliminates problems of contamination in operation.

Note in the illustration how compact the unit is. It easily fits into available plant space, required no additional construction. And since this unit has been installed, the processor reports complete elimination of problems due to clogging or leakage.

If your process could benefit from the top efficiencies, maximum temperature control, and higher capacities of the De Laval Plate Heat Exchanger, why not drop us a line requesting more information? There's no obligation to you, and it may well prove the answer to some of your processing problems.

EFFICIENCY PROBLEMS... DE LAVAL PROCESS EQUIPMENT

CENTRIFUGES . PLATE HEAT EXCHANGERS . VIBRATING SCREENS . COMPLETE PROCESSES

Processor of new detergent cleaned up recovery problem with fast, non-stop separator

Problem: A processor developing a new detergent made from vegetable oil needed an efficient method of recovering the expensive catalyst in re-usable form. Previous attempts had recovered non-dispersible catalyst in a hard cake form.

Solution: A De Laval AC-VO "Nozzle-Matic" Centrifuge. Since the heavy phase in the separation (containing the catalyst) is thrown to the bowl wall and discharged continuously as part of the machine's normal operation, the catalyst is recovered in a thick slurry. In this form, it is easily re-dispersed.

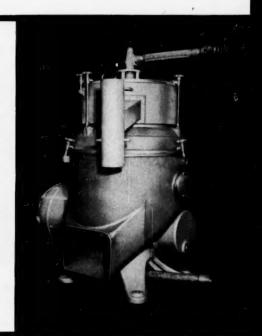
This particular unit was also supplied with a heavy phase recirculation feature. As the heavy phase is discharged through the nozzles built into the bowl wall, it is picked up and recirculated to the centrifuge bowl. The result is a higher concentration of the catalyst, and in a state of maximum clarification.

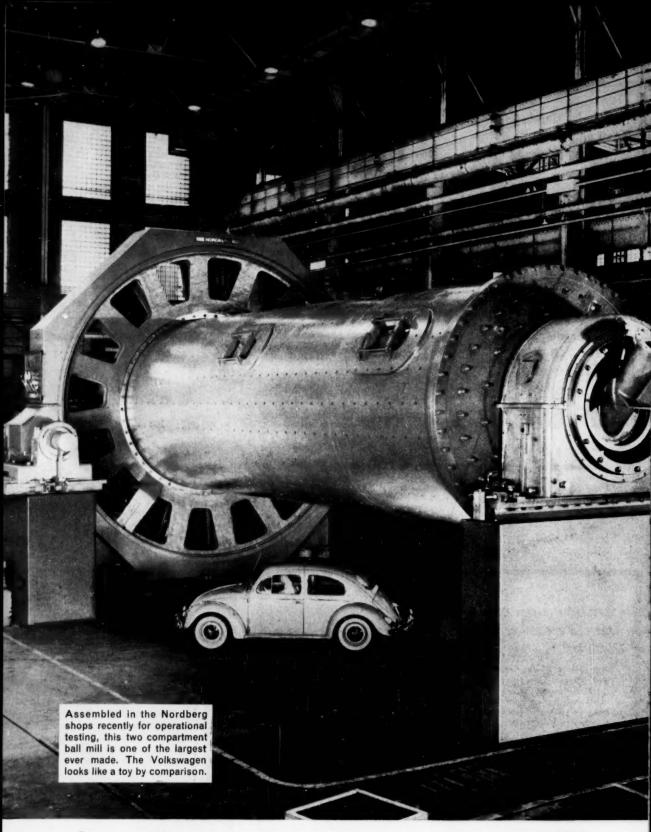
The higher capacities possible with De Laval continuous discharge centrifuges were important to this processor, too. Combined with the fast operation, they insured maximum catalyst life. Slow operation had been a factor in the hard caking of the catalyst in previous attempts at recovery.

Wherever recovery of a solid is important in your process, you should consider the different types of solids concentrators we make at De Laval. There is a type for every recovery operation.

Why not drop us a line for further information? Just tell us the type of recovery which interests you. There is

no obligation, of course.











SYMONS® CONE CRUSHERS



SYMONS VIBRATING SCREENS



SYMONS VIBRATING GRIZZLIES



ROTARY KILNS



NORDBERG ENGINES

NORDBERG sets the pace in LARGE GRINDING MILLS

to turn out greater tonnages at lower cost per ton

Nordberg has recently completed five of the largest grinding mills ever built for industrial service. These two compartment Nordberg ball mills (see opposite page) are 12 feet in diameter by 36 feet long, each powered by a 2500 hp synchronous motor, operating at 10% beyond rating. These mills are being installed in a new 5 million barrel per year wet process cement plant. The economies of using very large grinding mills to turn out greater tonnages at lower cost are important, however, to many other large ore and mineral reduction processes, as well.

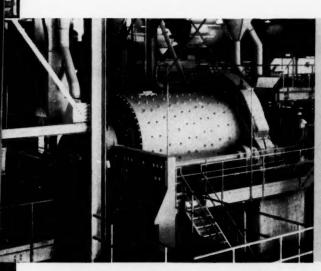
Consider some of these basic advantages:

1. Lower construction and installation costs . . . A single, large mill requires less floor space than several smaller ones, and only one foundation is required. Thus, construction costs are lowered and, in most cases, production is increased.

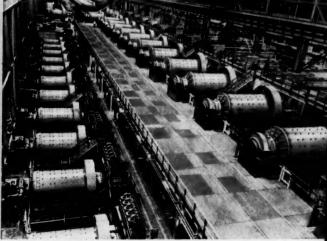
2. Simpler automatic operation . . . Where automatic operation is required, larger mills permit simpler handling with fewer controls. This lowers initial investment and minimizes installation and operational problems of automatic controls.

3. Less maintenance . . . Here, costs are again related directly to the number of mills installed. Fewer units mean less wearing parts and more dependable production. Exceptional savings may also be realized in replacement liners alone.

These are significant reasons behind the current trend toward larger grinding mills. But whether you require large or small grinding mills, you can count on the proven experience of Nordberg in furnishing the right grinding mill to meet your specific needs . . . including Rod, Ball, Pebble, Tube and Compartment types, in sizes from 6 to 13 feet in diameter and up to 50 feet in length. Write for further information.



Shown here are two of five 11' x 17' Nordberg Ball Millsthree raw and two finish-installed in a midwest cement plant that has a capacity of 3,000,000 bbl. annually.



The largest iron ore mill installation in the world with 58 Nordberg Grinding Mills. This concentrator building houses 27, 10' x 14' rod mills and 27, 10' x 14' ball mills. Four Nordberg mills serve as standby units.

NORDBERG MANUFACTURING COMPANY, Milwaukee 1, Wis.

SYMONS . . . a registered Nordberg trademark known throughout the world.



ATLANTA : CLEVELAND DALLAS

DULUTH

HOUSTON KANSAS CITY MINNEAPOLIS

NEW ORLEANS

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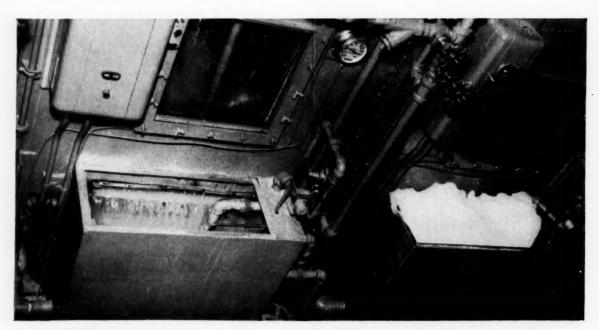
ST. LOUIS



PROBLEM: To find an insecticide formulation that would remain relatively dustless during storage. Several liquid nonionics were tried, but they lost their effectiveness in about six months by migration.

SOLUTION: Pluronic L62 was incorporated into the formulation. Because of its high molecular weight it did not migrate, and the wettable powder formulation remained dustless indefinitely.

Can Pluronic, polyols make a



PROBLEM: A formulator of a spray-type metalcleaning compound found he could get excellent detergency and emulsifying by using Pluronic L64. But he was troubled with excessive foaming.

SOLUTION: He added Pluronic L61 to the formula. This material generates almost no foam, and also acts as an effective foam suppressant. None of the compound's other properties were adversely affected.



PROBLEM: In the manufacture of grinding wheels, it is often desirable to produce wheels of dense structure. In the past, hot-pressing techniques were required to obtain this density.

SOLUTION: With Pluronic L62, it is possible to produce a resinoid-bonded grinding wheel of the same density by cold pressing. Pluronic L62 also improved the grinding efficiency.

new product possible for you?

WE DON'T KNOW. But it's a distinct possibility, because this unique series of patented block-polymers is extremely versatile. Here's why:

Pluronic polyols exhibit a wide variety of surfaceactive properties. The series ranges in physical form from mobile liquids and pastes to solids sufficiently hard to be flaked . . . all forms are 100% active.

Grades in this series have molecular weights as low as 1000 to more than 11,000. They vary from materials that are almost water insoluble to materials that have no cloud point—even at the boiling point of water.

These pictures show three typical uses of the Pluronic polyols. Actually, over 100 practical applications have been found so far, and the end is not in sight!

Isn't it possible that a series as versatile as this could find application in your business? For samples, technical data, and your copy of the Pluronic Grid, write us today . . . if you state your problem in sufficient detail, we'll make specific recommendations. Wyandotte Chemicals Corporation, Department 782-E, Wyandotte, Mich. Offices in principal cities.



The famous Pluronic Grid provides a controlled, systematic method of sample screening . . . minimizes costly random investigation and evaluation by establishing related property trends between the grades available.

Wyandotte CHEMICALS

MICHIGAN ALKALI DIVISION
Pacing progress with creative chemistry

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE • MURIATIC ACID • HYDROGEN • DRY ICE
GLYCOLS • SYNTHETIC DETERGENTS • SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLHYDANTOIN • CHLORINATED SOLVENTS • OTHER ORGANIC AND INORGANIC CHEMICALS

at your service at Orange, Texas -

Modern, Complete Plate Fabricating Facilities

Our modern Orange, Texas, plant, one of the largest plate fabricating facilities in the country, is now producing all kinds of custom plate work—including stacks, pipe, bins, tanks and heavy-wall pressure vessels. And, being located on water, rail and truck routes, delivery is fast and shipping costs are low.

The plant is a two-aisle building, 177' wide and 750' long, with extended crane runways of 270' and 200' lengths at either end. Equipment includes seven cranes capable of lifting, in combined use, over 100 tons; large car bottomheating and stress-relieving furnaces; heavy plate-bending

rolls; a variety of presses and press brakes; the latest in welding and X-raying equipment, plate shears, edge planers, boring mills and drills. An inquiry to the nearest contracting office will bring detailed information.

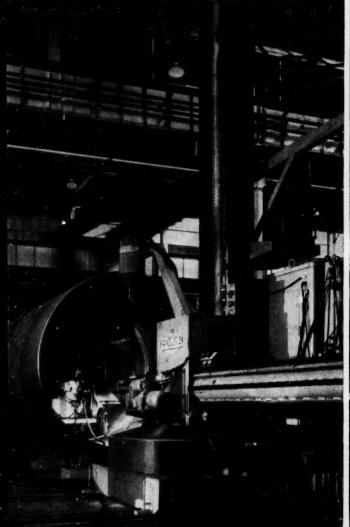
USS is a registered trademark



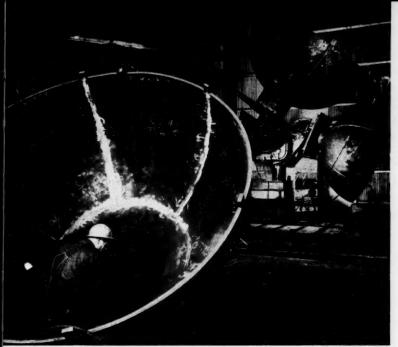
General Offices: 525 William Penn Place, Pittsburgh, Pa. • Contracting Offices in: Ambridge • Atlanta • Baltimore • Birmingham • Boston Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Elmira • Gary • Harrisburg, Pa, • Houston • Los Angeles • Memphis Minneapolis • New York • Orange, Texas • Philadelphia • Pittsburgh • Portland, Ore. • Roanoke • St. Louis San Francisco • Trenton • United States Steel Export Company, New York

Automatic welding inside circumferential butt joint of two 11/4" plates with boom welder.

Pressing 11/16" plates on 2000-ton press for hemispherical heads.





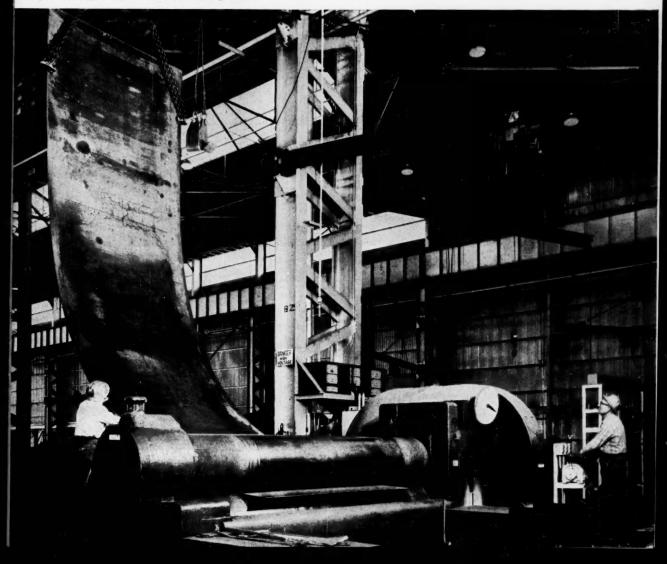


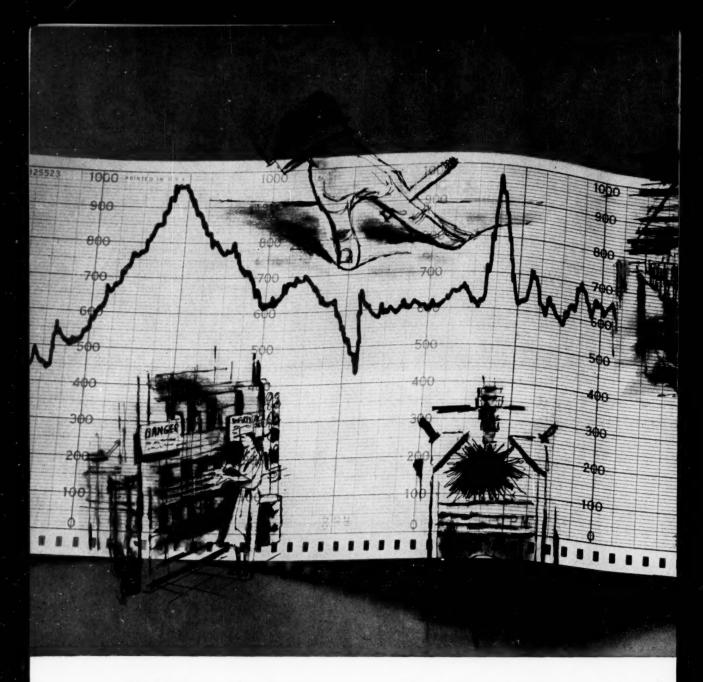
Inside of 9'-6" dia. x 11/16" thick hemispherical head being ground smooth.

Rolling 96" wide x 5/16" thick plate for knock-down storage tank.

Complete Construction Service

Possessing the most complete range of construction equipment in the industry and skilled personnel backed by over fifty years of experience, American Bridge is prepared to erect any product it fabricates.

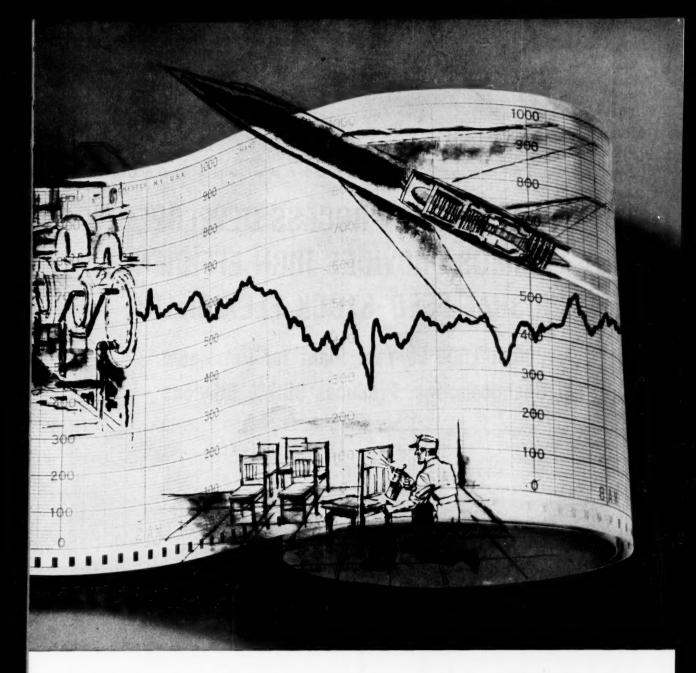




To tame heat and

Does heat or flame present a hazard in your business or product, or set a limit to the efficiency of equipment? If so, Celanese has some chemical answers for you:

We have developed—and produce—fire-resistant synthetic lubricants and hydraulic fluids, fire resistant plasticizers, fire-retardant additives for paints and varnishes, motor fuel additives that improve combustion, and heat-resistant lubricants for high temperature applications. These products are typical examples of the contribution of Celanese to safety and progress in American industry. Take advantage of our long experience in reducing the hazards and losses of heat, fire and explosion. If you have such a problem, why not ask us to help? Write Celanese Corporation of America, Chemical Division, Dept. 553-J, 180 Madison Ave., New York 16.



keep fire friendly

LEFT TO RIGHT

- Cellulubes, fire-resistant hydraulic fluids for safer operation of die casting machines, hydraulic presses and other power transfer units near potential sources of ignition.
- Celluflex plasticizers add fire resistance to urethane foams and other plastics.
- Fuel additives improve performance characteristics of gasolines.
- Cellulubes, combustion-resistant lubricants for air and gas compressors, also reduce maintenance costs.
- Celluflex plasticizers contribute the property of fire retardance to paints and varnishes.
- Cellutherm high temperature lubricants for faster jet engine speeds.



Canadian Affiliate: Canadian Chemical Company Limited, Montreal, Toronto, Vancouver Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., New York 16, N. Y.



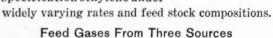
ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

NEW ETHYLENE PROCESS DEVELOPED BY LUMMUS PROVIDES HIGH EFFICIENCY, UNUSUAL FEED-STOCK FLEXIBILITY

200,000,000 Lb/Year Plant for Petroleum Chemicals, Inc. Produces 99.7% Ethylene

The new Petroleum Chemicals, Inc. ethylene plant, now on stream at Lake Charles, Louisiana, incorporates a unique ethylene separation process developed by Lummus which provides high separation efficiencies and unusual flexibility and reliability (See flowsheet).

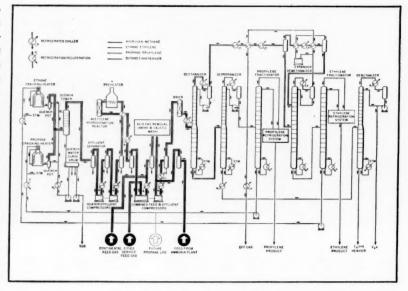
Lummus has designed the plant for rapid 50% expansion to a rate of 300,000,000 lbs/year. Ethylene is produced in two grades — the highest, 99.7%; the other, 98%. Coproducts are high purity propylene, a butane-butylene fraction and aromatic distillate. Operations have been marked by continuous production of specification ethylene under



Feed gases for the P.C.I. plant are provided from three different sources: the nearby refineries of Cities Service and Continental Oil—by whom P.C.I. is jointly owned—and P.C.I.'s new ammonia plant.

High Efficiency Expanders

All major compressors in the Lummus-designed low temperature fractionation unit are driven by three 12,500 HP gas turbines. Gas turbine exhaust



serves as preheated air for three high pressure steam generators. High efficiency expanders provide low temperatures for maximum ethylene recovery.

Ethylene is delivered via pipeline to customers at Orange, Texas. In addition, part of the new plant's output feeds the adjacent Calcasieu Chemical Corporation ethylene oxide and glycol plant, also engineered and constructed by Lummus.

This plant brings the total of Lummus-designed ethylene plants to 13, with a combined capacity of over 1 billion pounds per year: (contd. next page)

CUSTOMER

Monsanto Chemical Co. Jefferson Chemical Co. E. I. du Pont de Nemours & Co. Orange, Texas, U.S.A. Texas Eastman Co. Gulf Oil Corp. Societe Naphtachimie S.A. Allied Chemicals Corp. National Petrochemicals Corp. Tuscola, Illinois, U.S.A. Canadian Industries, Ltd.

(2 plants) Polymer Corporation Ltd. Societa Edison Petroleum Chemicals, Inc.

LOCATION

Texas City, Texas, U.S.A. Port Neches, Texas, U.S.A. Longview, Texas, U.S.A. Port Arthur, Texas, U.S.A. L'Avera, France Tonawanda, New York, U.S.A. Edmonton, Alberta, Canada

Sarnia, Ontario, Canada Mantova, Italy Lake Charles, La., U.S.A.

pany, the plant utilizes the two-step Shell Development Company Process, which offers the advantages of unusually high yields and virtual elimination of the waste-disposal problems encountered in the Chlorohydrin Process. The first step is direct catalytic oxidation of ethylene with oxygen in fixed bed reactors. Here ethylene oxide, valuable petrochemical intermediate, is produced for use by manufacturers of detergents and other surface active agents, plasticizers, solvents, textiles, drugs and many other petrochemical compounds.

The second step of the Shell Process calls for thermal hydration of ethylene oxide to ethylene glycol, essential to manufacturers of antifreeze, explosives, plasticizers, fibers, resins, hydraulic fluids and many more chemical products.

New Ethylene Oxide-Glycol Plant is third Shell process unit engineered and built by Lummus

Calcasieu Chemical Corporation's new ethylene oxide-glycol plant at Lake Charles, Louisiana is on stream and producing 8,000,000 gallons annually of ethylene glycol or 57,000,000 pounds of ethylene oxide.

Designed and engineered by The Lummus Com-



Over a half-century of Process-Industry experience

Here is just a partial list of chemicals for which Lummus has designed, engineered or constructed plants:

Dichlorethane

Dichlorobenzene

Di-isobutyl alcohol

Acetone Acrolein Allethrin Ammonia Ammonium Nitrate Ammonium Sulfate Benzol Beryllium metal Bisphenol Butadiene **Butanedio!** Butynediol Butyrolactone Carbon black Caustic soda Chlorobenzene Di-ammonium phosphate

Ethylbenzene Ethyl Chloride Ethylene Ethylene glycol Ethylene glycol Ethylene oxide Epon® resin Formaldehyde Heavy Water Hydrogen Hydrogen Sulfide Isopropyl alcohol Lamp black Magnesium sulfate Mercuric nitrate Naphthalene

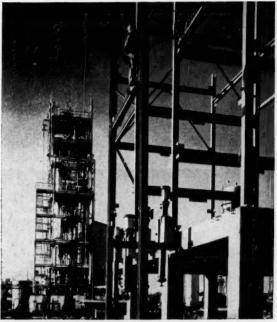
Nitric Acid Phenol
Phthalic anhydride
Polyvinyl alcohol
Polyvinyl Pyrrolidone
Propargyl Alcohol
Propargyl Alcohol Propyle Pyrrolidone Styrene Sulfuric acid Surfactants Tetramer Trichlorethylene Trichlorobenzene Toluene Uranium Oxide

Discuss your next chemical or petrochemical project with a Lummus representative.

THE LUMMUS COMPANY, 385 Madison Avenue, New York 17, N. Y., Houston, Washington, D.C., Montreal, London, Paris, The Hague, Maracaibo. Engineering Development Center: Newark, N.J.

Article tells when to contract for pilot plant work, when to 'do it yourself'

Reprints are available now of a four-page article which discusses factors to consider in deciding when to engage an outside firm to do pilot plant work and when to "do it yourself." The article includes a comparative analysis of costs on a specific project: (a) as actually completed by Lummus for a client and (b) if the client had undertaken the program himself. For copies, write Lummus.



MORE POLYVINYL ALCOHOL RESIN - 20 million pounds per year will come from Air Reduction's new installation in Calvert City, Kentucky, now being engineered and built by Lummus. Shown above are Airco's original vinyl acetate monomer plant and the beginning of the new monomer plant which will double vinyl acetate output. The twin monomer plants will be the core of the huge polyvinyl alcohol resin operation, scheduled to come on stream early next year.

CYANAMID

Chemical Newsfront



NEW PROCESS IMPROVES PURITY OF PHTHALIC ANHYDRIDE. Over ten years of Cyanamid research and development results in an improved method of maintacturing pitthalic andydride. In operation at Cyanamid's Bridgerille. Periosch and plant, the new process involves called the oxidation of maphithalicing in flind bad can efters—results in greater purity. Similar improvements currently in progress-will expand Cyanamid's makin advanted capacity at Bridgeville from LE mallion pounds aroundly to 20 million pounds. These developments will readile Cyanamid to meet the increasing needs of themany users of linth plathalic and making ally dride. Electromad Resign Biggeri



DYE-DUSTING PROBLEMS END FOR GASOLINE REFINERS using Cyanamid's CALCOGAS ROCKET RED. Superior to powdered oil reds, this new red dye eliminates dusting problems in storage and handling. Non-dusting, non-caking and extremely soluble, its granulated form facilitates use in automatic metering and mixing equipment. Because of its non-caking properties, Calcogas Rocket Red resists physical change even at the high temperatures often found in refinery storage areas. In addition to the new Rocket Red Calcogas, Cyanamid also manufactures and sells other exceptionally soluble, dustless colors to the petroleum industry such as Calcogas Orange NC and Calcogas Yellow NC. (Dyes Department)



NEW PAPER INSULATION UPS PEAK TRANSFORMER LOAD CAPABILITY 20%. Cyanamid's ACRYLONITRILE has helped General Electric Co. develop a new paper for the insulation system of its poletype distribution transformers. Paper manufacturer Hollingsworth & Vose Co. produces the new insulating paper for G.E. from kraft pulp chemically treated with acrylonitrile. In a process known as cyanoethylation, acrylonitrile is added to the pulp to modify its chemical structure and greatly strengthen heat-resistance and retention of dielectric and tensile strength properties. Pulp treated with acrylonitrile also results in substantially improved dimensional stability—important for applications such as map paper and business machine punch cards.

(Petrochemicals Department)

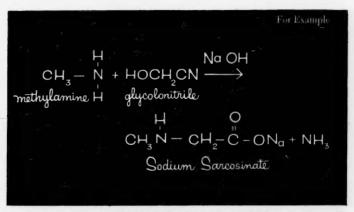
TEXTILES STAY CLEANER... WON'T CLING when treated with Cyanamid's CATANAC® SN Anti-static Agent. A small amount of Catanac SN in relation to the weight of the material is usually sufficient for complete control of annoying static electricity. Catanac SN is effective on all fibers, including the synthetics. Application may be made by brush, pad, or spray and, on washable items, by addition to the rinse water. Catanac SN has proved a boon to many industries as well as to the consumer. When used in textile coning oils, for example, it is beneficial in keeping the lubricated material static-free during processing.



CYANAMID

AMERICAN CYANAMID COMPANY SO ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

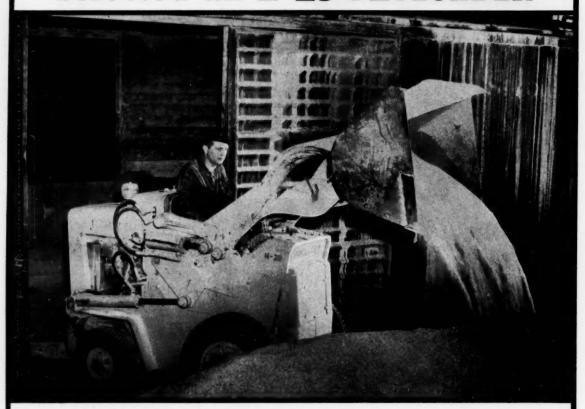
CHEMICAL ENGINEERING—October 19, 1959



A BETTER WAY TO MAKE α -AMINO ACIDS. The availability of Cyanamid's AERO Glycolonitrile has made possible the use of an easier and better method for producing α -amino acids. This process is based on the condensation of glycolonitrile with ammonia or amines, followed by hydrolysis of the resulting aminonitrile. By combining hydrogen cyanide with formaldehyde to form glycolonitrile, Cyanamid has greatly reduced the hazards and difficulties encountered in using free hydrogen cyanide. The glycolonitrile route to α -amino acids can result in economic advantages. (Process Chemicols Department)

mail this co	nformation on products in this advertisement wire, phone — pon to:
AMERICAN	CYANAMID COMPANY
30 Rockefell	r Plaza, New York 20, N. Y.
	ne additional information
	CALCOGAS ROCKET RED
	PHTHALIC ANHYDRIDE
	☐ ACRYLONITRILE
	☐ CATANAC® SN Anti-static Agent
	☐ AERO Glycolonitrile
Name	
Company	
Position or Ti	•
Address	
City	Zone State

Why Illini Phosphate Company selected an H-25 PAYLOADER®



When this Champaign, Illinois fertilizer manufacturer decided to replace one of its model HA "PAYLOADER" units (that hadn't even had the engine head off in six years) it chose a model H-25... but not before it had won a side-by-side competitive demonstration.

Harry Lange, foreman, summed up the reasons for their decision, "The H-25 had a lot of advantages in getting in and out of boxcars and getting around to the different fertilizer bins. The other was too slow and sluggish."

William Scott, operator, added, "The H-25 is quicker on the lift, dump and go, gets into smaller places, has more power and digs-in faster to get quick, full loads.

Want to find out what an H-25 can do in your plant? Want to see what its 2,500 lb. carry capacity, only 6-ft. turning radius, power-shift transmission (with two speeds each direction), easy power-steer, and many other advance features can do for *your* production? Ask your Hough Distributor for a demonstration.

- 1. Faster Operating Cycles
- 2. Far More Compact
- 3. Gets Full Loads Faster

THE FRANK G. HOUGH CO. 754 Sunnyside Ave., Libertyville, III.	10-A-1
Send data on the H-25 "PAYLOADER"	
Name	Title
Company	
Street	
City	State

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П	U	U	U	





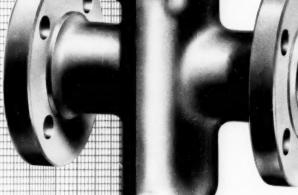
NOW! THE BOLD ADVANCE

IN VALVE DESIGN

W-K-M's NEW Pressure Sealing GATE VALVE

This superior valve gives you all these advantages:

- Tight seal both up and downstream in open and closed position
- Full bore, through-conduit
- Non-lubricated
- Seats automatically adjust for wear
- Automatic relief of excessive body
- Ideal for abrasive ladings, light gases, volatile liquids up to 250° F.
- Easy to overhaul on the line



ASA 150 lb. (275 cwp) and ASA 300 lb. (720 cwp)

ANOTHER OUTSTANDING

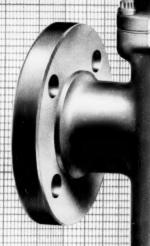
WHEM'S Creative Engineering

NOW! THE

W-K-M's NEW

Pressure Sealing

GATE VALVE



ASA 150 lb. (275 cwp) and ASA 300 lb. (720 cwp)

ANOTHER
OUTSTANDING
PRODUCT OF

W-K-M

BOLD ADVANCE

IN VALVE DESIGN

Tested and Proved in the Toughest Services!

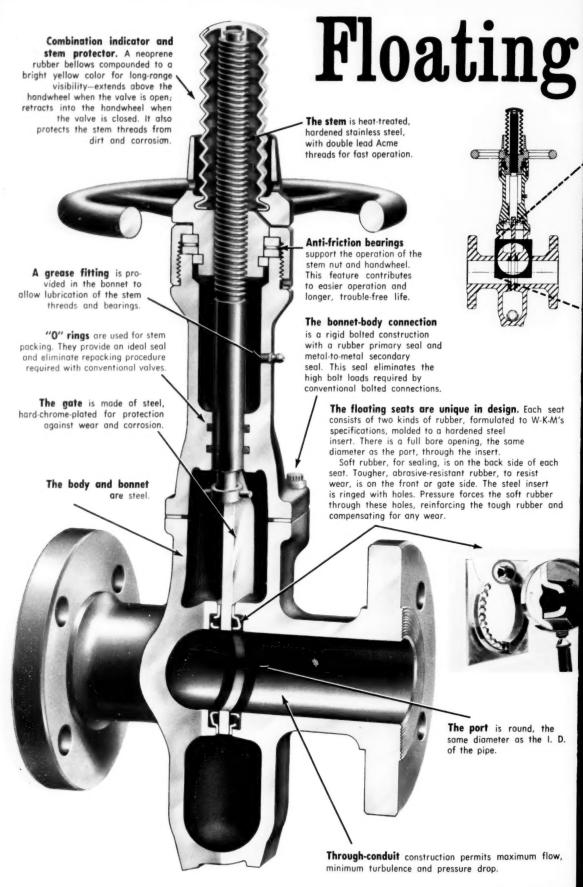
Enthusiastic, completely favorable user reports affirm the superior quality and effortless operation of W-K-M's new Pressure Sealing Gate Valve. "Handles all the sludge in a gas blowout line easily — works better than any valve we've used," states a petroleum engineer. A foreman says,"... easiest operating valve I ever saw... smoothest working valve made." Similar reports covering many other services are in W-K-M's engineering test data files.

Turn the page to see the design features that make this unique valve so outstanding

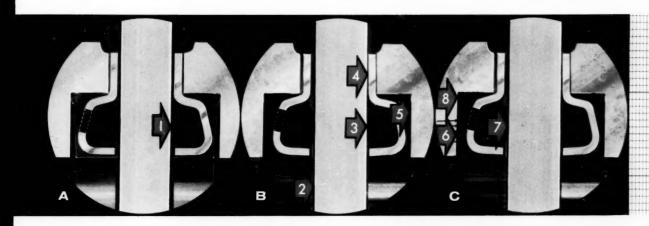
DIVISION OF OCT INDUSTRIES

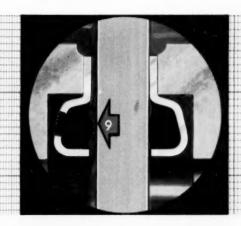
INCORPORATED

P. O. BOX 2117, HOUSTON, TEXAS



Seats Give Perfect Seal





Line Pressure Seals the Seats!

Illustration A shows the gate in the closed position as it forms a primary seal (1) with the raised ring of tough, firm rubber on the face of each seat.

As line pressure (2) is applied to the valve in Illustration B, the gate is forced against the rubber ring on the downstream seat (3) and compresses it until the gate rests against the hardened steel insert (4). This provides a tight seal between the gate and the rubber on the face of the seat, and a secondary metal-to-metal seal. The action also forces the soft rubber on the back of the seat tightly into its recess (5) and prevents any downstream flow at this point.

This double action provides a bubble-tight downstream seal.

The upstream seal shown in Illustration C is caused by line pressure forcing its way into the seat recess behind the upstream seat (6), thereby moving the seat against the gate (7). This pressure is sufficient to achieve a positive seal between the gate and the ring of tough rubber on the face of the seat. At the same time, the raised rim of soft rubber on the back of the seat forms a tight seal with the seat recess (8).

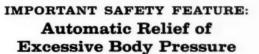
These double-action floating seats provide tight, positive seals—both upstream and downstream.

Two-Way Valve

W-K-M's Pressure Sealing Gate Valve is a twoway valve. It may be installed with the pressure on either side. This valve is especially well suited for block and bleed service since it seals positively both upstream and downstream. The body may be bled of pressure with the gate in either the fully open or fully closed position.

Full Bore, Through-conduit

The full bore, through-conduit gate construction provides a perfectly smooth bore through the valve, eliminating pockets or cavities in which foreign matter might accumulate. Result: perfectly smooth flow with no more turbulence or pressure drop than through an equal length of pipe.



This valve has been designed to automatically relieve excessive body pressure caused by thermal expansion. The excess pressure forces the upstream seat away from the gate (9), allowing it to bleed into the line.



Change Seats in Minutes ... on the Line!

Construction of the valve is so strong and materials are so durable that users so far have found maintenance unnecessary. But in time every material wears, and some maintenance is required.

When that time comes you can change the seats in W-K-M's Pressure Sealing Gate Valve (2" through 12") in 15 to 30 minutes on the line. The only tools needed are a wrench to loosen the body bolts, and a pair of pliers.



ONE OF THE MOST VERSATILE VALVES EVER PRODUCED

WKM's NEW Pressure Sealing GATE VALVE



Natural Gas Transmission



Crude Oil



Butane/Propane



Natural Gas Distribution

Proved in the Field!

This new valve is extremely versatile. It's designed for pressures up to 720 psi (cwp) and temperatures up to 250° F. Here are only a few of the services in which it will perform efficiently and economically.

Gasoline

Abrasive Slurries

Alkaline Solutions

Solvents

Nitric Acid

Sulphuric Acid

Methyl, Ethyl, Butyl, Propyl

Alcohols

Ethylene Glycol

Butyl Stearate

Kerosene

Naphtha

Stoddard's Solvent

Carbon Tetrachloride

Water

Air

SPECIFICATIONS

Valve Size	2"		3"		4"		6"		8"		10"		12" *	
ASA Rating (lbs.)	150	300	150	300	150	300	150	300	150	300	150	300	150	300
Screw End	X	Х	Х											
Weld End	X	X	Х	Х	Х	X	X	Х	X	X	X	X	X	X
Weld by Flange	X	Х	X	Х	Х	Х	X	X	X	X	Х	X	X	X
Flanged End	Х	X	X	X	X	X	X	X	X	X	X	X	X	X
Gear Operated							X	Х	X	X	X	X	X	X

*14" and larger available on request

AVAILABLE NOW at competitive prices from your supplier.

For complete information about W-K-M's new Pressure Sealing Gate Valve . . .

WRITE FOR CATALOG 1200

W-K-M Division of ACF Industries, Incorporated P. O. Box 2117 Houston 1, Texas





TA FLAMMABLES ENGINEERING BY PROTECTOSEAL

FLAMMABLES CONTROL METHODS AND PRACTICES IN PRODUCTION, PROCESSING AND IN MAINTENANCE

How to dispose of corrosive liquids

Special steel containers with glass liners have been developed for the safe, economical disposal of corrosive flam-

mable wastes that would ordinarily corrode standard metal contain-ers. A selfclosing cap with hold - down catch provides pressure relief. Easily removed Bail Handle collar permits glass liner to be removed for cleaning and replacement.



For Further Information Circle Item 35 on Caupon.

Space-saving dispensers for measured laboratory flammable supplies

Single or double unit space-saving dispensers in laboratories and at pro duction processes are being rapidly



adopted for convenience and accuracy in dispensing measured amounts of out-of-the-way liquids. These mountings avoid hazardous spillage and conserve employee time. The cans tilt easily for dispensing into laboratory vessels and return to an upright position when not in use. The built-in faucet is of the self-closing, safety type which automatically stops the flow of the liquid when hand pressure is removed.

For Further Information Circle Item 27 on Coupon

Antidote to a flammables transfer dilemma . .

Chemical plant supervisors and safety engineers have long been plagued by the use of non-approved pumps for transferring hazardous liquids from drums.
Switching of transfer
pumps from one drum
to another inevitably invites use of the wrong pump. Why not the use of a transfer pump equally efficient and safe whether in light oils or flammables? Shown at the right is a Protectoseal



transfer pump equally efficient for pumping many light oils as well as flammable liquids.

For Further Information Circle Item 37 on Coupon

NEW! Complete Protectoseal Safety Engineering Equipment Catalog and Manual

Just published, is a practi-cal working guide to the safe, cost-cutting use of flammable liquids in plant and laboratory. It covers in detail the complete handling and safe-guarding of flammables from receipt on the premises, through each individual ap-

plication, to final disposal.

Divided into six sections for quick, convenient use, the catalog presents the safety problems involved in em-ploying flammables at each activity; then illustrates and describes the specially designed safety containers and signed safety contamers and dispensers which provide complete worker and plant protection from flash-fires and explosions, and fit naturally and easily into each production process.

Sectional divisions include:

Characteristics Hazards

1-Characteristics, Hazards and Safe Control of Flamma-Hazards

ble Liquids—a complete account of the commonly used flammables and an introduction into basic fire prevention methods and devices. 2—Drum Storage and Dispensing—basic safeguards to be observed in drum storage and dispensing operations. 3—In-plant Storing, Transporting and Dispensing—instrucof safety containers for in-plant handling. 4—Production and Maintenance Operations—a guide to the safe, productive use of flammables. 5—Disposing of Flammable Waste—presenting approved procedures for disposal. 6—Specialized Applications and Flammables Engineering Services-designing, engineering, manufacturng safety equipment to meet special application needs

The Catalog is an invaluable, detailed guide for all chemical processing engi-neers, laboratory technicians, and all concerned with the safe, economical and efficient use of hazardous liquids.

Check coupon to request your personal copy of the catalog.



Each Section Consists of

Flammables Engineering **Fundamentals**

Recommendations as to the safe, productive uses of hazardous liquids with guides to selecting the proper types of equipment.



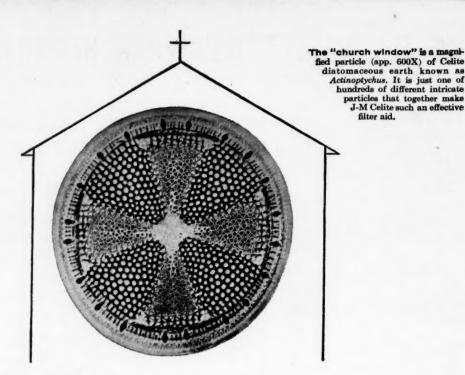
Safety Equipment **Specifications**

Complete, detailed descriptions of the capacities, sizes, construction and operating features of all types of safety equipment.



SEE OUR EXHIBIT AT THE 27TH EXPOSITION OF CHEMICAL INDUSTRIES

Supply Can Safety Can Safety Can Safety Enginee More Information on the Ite The Protectoseal Company 1948 South Western Avenue, Cl	Ovel Table-Top Id copy of the new Protectoseal ing Catalog and Manual ms Circled Below: 27 - 35 37	ROTAL ROTAL RACE BAR- RAL- RAL- RAL-
Name	Title	
Company Name		



What's this "Church Window" got to do with more uniform filtrations?

It's a particle of CELITE that's always uniform



The secret of Celite diatomite's remarkable filtration properties is shown in this magnification. It reveals the open passages between particles, and the porosity of the particles themselves through which liquids flow freely. Yet these openings are so microscopic that they trap even the finest insoluble impurities.

Johns-Manville CELITE



Provides sparkling clear drinking water. Many municipalities depend on Celite filtration to help keep drinking water uniformly healthful and pure. Celite efficiently removes amoebae and algae... reduces the need for other chemical treatment.

Removes oil from urea solutions. Hyflo and Sorbo-Cel, two special grades of Celite, are used by the chemical industry to filter oil from urea solutions used to make plastic grade resins.

-the diatomite filter aid from bag to bag

Buy a bag of Celite* in New York today. Next year, buy another bag of the same grade in California. You can depend on getting the same performance from both bags because Celite is always uniform.

Every pound of Celite comes from the world's largest and purest commercially available diatomite deposit. Every pound is processed and graded at the same plant under the same conditions. Yet, with the large inventory maintained at the plant and Johns-Manville's nationwide network of warehouses, you're assured of fast, sure delivery when and where you want it.

Celite gives you more economical filtration, too. Because of its lower wet density, you get greater surface coverage—actually 6 bags of Celite will do the work of 7 bags of other diatomites. Celite filter powders come in a full range of grades. It's easy to select the one grade that gives you the clarity you need at the fastest flow rate.

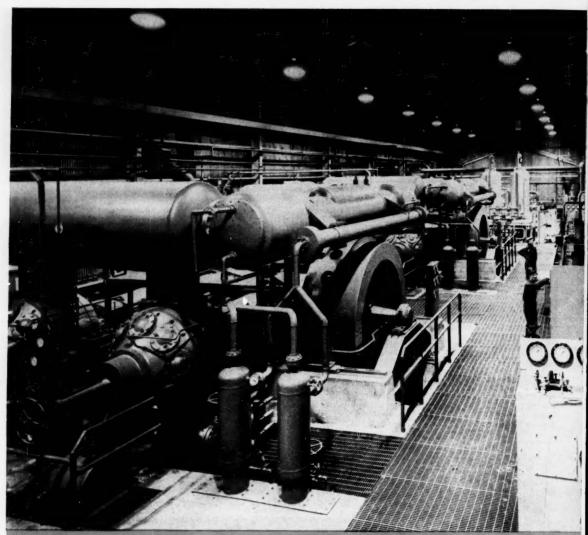
So, if filtration belongs in your

processing operations, it will pay you to call in your local J-M Celite engineer. Backed by Johns-Manville's research facilities and years of practical diatomite experience, he can help you with your filtration problems. Call him today or write Johns-Manville, Box 14, New York 16, New York. In Canada, write 565 Lakeshore Road East, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

Diatomite Filter Aids





Class "FE" horizontal, balanced-opposed compressors; 3,500 hp; five-stage; 3,000 psig.

Type "T" single-stage, oil-less cylinder gear-driven hydrogen recycling compressor.

Horizontal, straight line, double-acting types; single or multi-stage; lubricated or non-lubricated; 15 to 150 hp; pressures up to 5,000 paig.



Chicago Pneumatic . East 44th Street, New York 17, N. Y.

HR AND GAS COMPRESSORS - VACUUM PUMPS - PREUMATIC TOOLS - ELECTRIC TOOLS - DIESEL ENGINES - ROCK DRILLS - HYDRAULIC TOOLS





Type "P" air-cooled, motor driven compressor; 71/2 to 125 hp.

Class "Y" package-type compressor; 75 to 300 kp; pressures up to 5,000 psig; lubricated or non-lubricated.



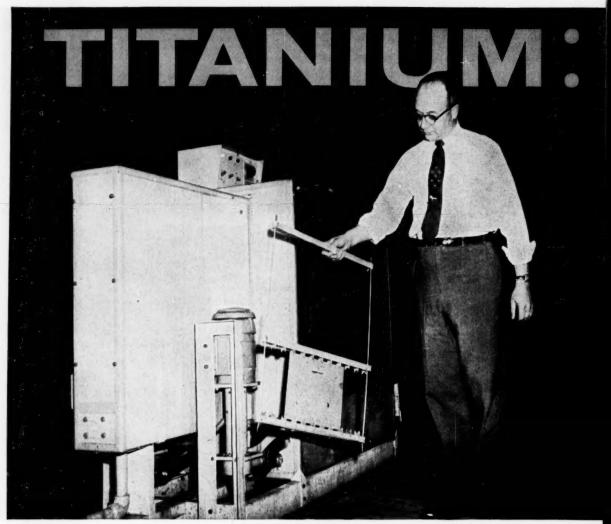
Class "H" four corner, steam-driven compressor; 150-1400 hp. One of two 30" stroke, 1,000 hp hydrogen recycling units.



from

VACUUM to
15,000 PSIG
7½ to 5,000 HP

There's a CP COMPRESSOR for every process need



DSP MARK II Etcher, designed and built by Centre Circuits, Inc., State College, Pennsylvania, expressly for Dry Screen Process, Inc. This etcher (1) prints circuit in wax base thermal plastic-resistant material on copper-clad fiberglass sheets; (2) sprays the sheets with etchant to remove the unprinted copper; and (3) removes the plastic-resistant material by de-greasing, leaving the bare copper circuit.

Titanium components "unetched" by $FeCl_3...Cr_2O_3 + H_2SO_4...(NH_4)_2S_2O_8...$

Like hundreds of non-military titanium users, Dry Screen Process, Inc., Pittsburgh, Pennsylvania, has found that titanium—despite its higher initial cost—can be the most economical solution to severe corrosion problems.

Dry Screen Process, Inc., manufactures equipment used in processing printed electronic circuits. They needed a metal that would resist highly corrosive etching solutions: ferric chloride . . . chromic sulfuric acid . . . ammonium persulphate.

In addition to 4" diameter titanium for vertical members of immersion racks (one is seen above), the company uses 1" diameter Republic Titanium for pump shafts. These are in constant contact with the etching solutions. Machines utilizing titanium components have been in service for more than a year.

Recent inspections revealed what Dry Screen Process, Inc., wanted—absolutely no corrosion!

The complete immunity of titanium to sea water and salt spray is well established. Titanium also resists attack by a number of molten metals, and weld zones are comparatively insensitive to preferential attack. The chart above lists information on the corrosion-resistance of Republic Titanium to more than a dozen reagents. For a comprehensive listing, mail the coupon.

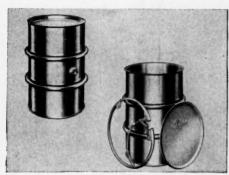
To help you select, apply, and process titanium, Republic 3-DIMENSIONAL Metallurgical Teams will work closely with your own metallurgists and engineers. Comprised of field, mill, and laboratory metallurgists, they can help you solve even the most severe corrosion problem.

the cost is justified!

CORROS	Time of	Rate (ipy)			
Reagent	Conc. (%)	Temp. °C.	(hours)	Corrosion	
Acetic Acid—Glacial	99	B. P. (119)	300	<.0001	
Ammonium Chloride	saturated	100	144	nil	
Bromine	vapor	30	24	<.0001	
Citric Acid	50	100	144	.00005	
Carbon Tetrachloride +1% water	100	Boiling	300	<.0001	
Chlorine Gas (water saturated)	100	75	30	<.0001	
Ferric Chloride	10	Boiling	300	<.0001	
Hydrogen Peroxide (C. P.)	30	Room		<.012	
Hydrochloric Acid (aerated)	5	Room	144	<.0001	
Lactic Acid	85	Boiling		.0002	
Nitric Acid (aerated)	10	35	144	.00016	
Phosphoric Acid	10	80	300	.072	
Photographic Emulsions				<.0001	
Sodium Hydroxide	28	Room	300	<.0001	
Sulfuric Acid	10	Room	300	.0072	
Tannic Acid	25	100	144	nil	



5/8" REPUBLIC TITANIUM TUBING (surrounded by a galvanized steel pipe water jacket) is used by the Kuehne Chemical Company, Elizabeth, New Jersey, in the manufacture of sodium hypochlorite. From a reactor tank, this bleaching fluid is transmitted through the tubing at the rate of eight cubic feet per hour. Of the materials capable of resisting sodium hypochlorite, titanium offered greater strength and reasonable cost. Republic's Steel and Tubes Division—world's leading producer of specialty tubing—has the experience and facilities to put this new metal to work in difficult tubing applications. Mail coupon for complete information.



SPECIFY REPUBLIC STAINLESS STEEL DRUMS for handling and storage of easily contaminated or highly corrosive packaged goods. Unaffected by most chemicals, ENDURO® Stainless Steel offers little foothold for contaminants or bacteria. These drums are built to withstand hard use. They require no painting. Available in 55- and 30-gallon sizes, double-seamed or all-welded construction with 1-bar or pressed out rolling hoops. Mail coupon for details.

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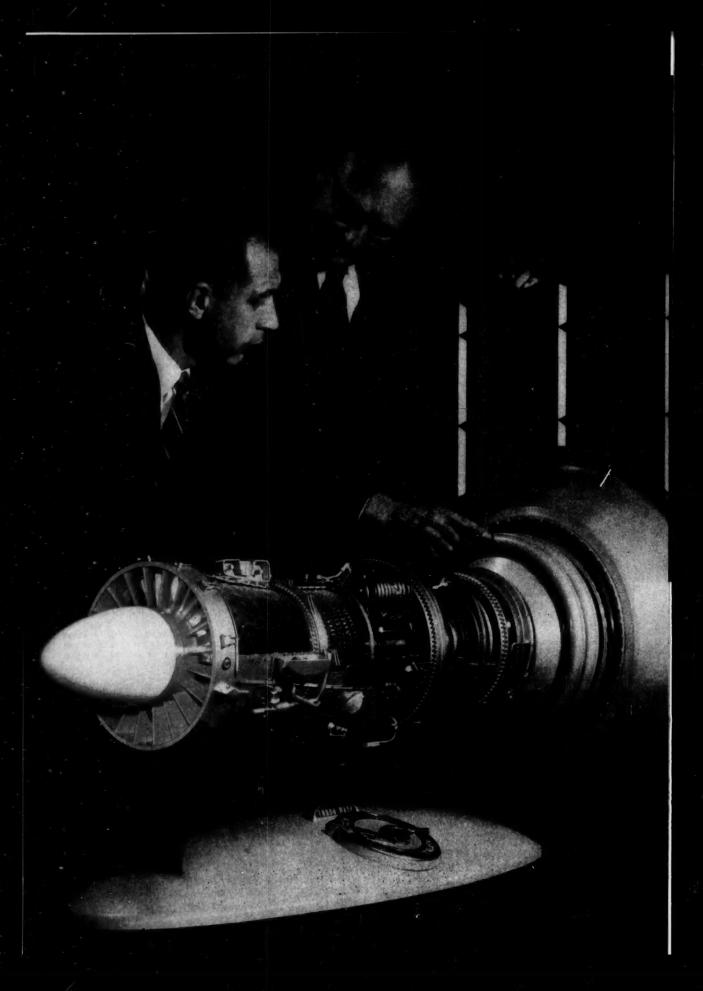
- □ Republic Titanium
- ☐ Republic Titanium Tubing
 ☐ Stainless Steel Drums and Barrels

Name_____Title

Company____

Company

City_____ Zone___State____



How Cooper-Bessemer is teaming up with Pratt & Whitney Aircraft to develop JET TURBINE POWER for industry

The cutaway model shown is a revolutionary new concept in gas turbines. The generating unit is a new Pratt & Whitney Aircraft jet engine—a modification of the famous J-57 aircraft engine, designed for gas fuel. The companion power unit is a new Cooper-Bessemer power turbine. This combination, now in the advanced experimental stages, represents the hottest development in industrial power in 20 years. It will mean drastic economies in installations of engine-driven compressors, generators and other rotating machinery.

For example, in gas compressor stations, it is expected to reduce total station cost by 50%!

Plans call for this new gas turbine to be available for broad application within 18 months. In the meantime, watch for reports on further developments in this pioneering teamwork by Cooper-Bessemer and Pratt & Whitney Aircraft.

BRANCH OFFICES: Grove City • New York • Washington • Gloucester Pittsburgh • Chicago • Minneapolis • St. Louis • Kansas City • Tulsa New Orleans • Shreveport • Houston • Greggton • Dallas • Odessa • Pampa Casper • Seattle • San Francisco • Los Angeles

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ENGINES: GAS - DIESEL - GAS-DIESEL COMPRESSORS: RECIPROCATING AND CENTRIFUGAL, ENGINE, TURBINE OR MOTOR DRIVEN

Quarter with model of experimental was for line lie my developed by C. ye. So we had and Pratt & Whitney Aucraft Units should be available for use within 18 months.



This is a 1½" Teflon hose, actual size, bending to

A DIAMETER OF 63/4" AT-65° F!

Impossible to produce? TITEFLEX did it, and only TITEFLEX has it! Industry's idea of what flexible Teflon hose in large diameters can and cannot do has changed overnight.

THESE ARE THE FACTS:

- Minimum bend radius is only 3% times diameter! Available up to 2 inch diameter, lengths to 25 feet.
- It has all Teflon's important features: fatigue life sets endurance records...it's tough, friction-free, light, inert, highly resistant to corrosion and extreme temperatures.
- Teflon innercore is convoluted by exclusive process, and reinforced with TITEFLEX heavy-duty wire braiding.
- Seal faces pressure tight. Braid, innercore and fittings are made practically one by the TITEFLEX method.

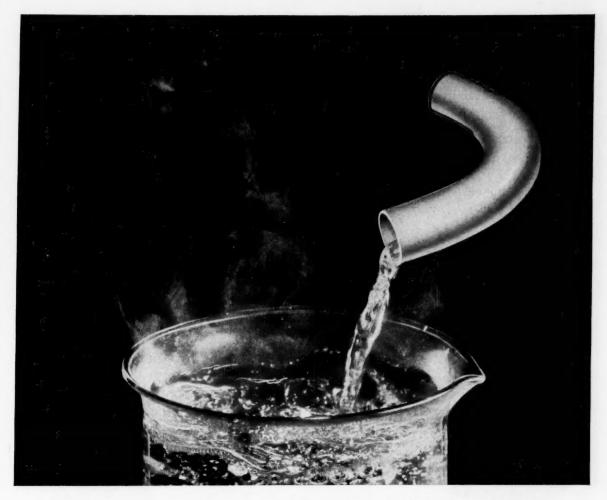
Already Springfield "400" is in use for live steam, alcohols, methanol and corrosive fluids. New uses for the toughest jobs are found every day...how about your operation? Get a copy of our bulletin from your TITEFLEX Distributor (in the Yellow Pages). Or drop us a line.

<u>titeflex</u>

9

*T.M. of duPont **T.M. of Titeflex, Inc., Pat. Pend.

titeflex inc. springfield mass. PACIFIC DIVISION - SANTA MONICA - CALIFORNIA



Meet your need for CHEMICAL RESISTANCE with hose of Du Pont TFE resins



Hoses lined with Teflon are used here to handle chemicals and solvents in compounding cosmetics, colognes, room deodorants and insecticides. "Waxy" surface of Teflon prevents holdup, absorbs no odors, and permits easy cleaning for service changes without contamination.

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

If resistance to acids and solvents is a *must* in your process, consider hose lined with Teflon TFE-fluorocarbon resins. These tough materials are totally inert to virtually every chemical encountered in industrial processes. Hose lined with a Teflon TFE resin is rated for continuous use up to 500°F, and will handle superheated steam; yet it is useful even in liquid-oxygen service. It is tough, long-lasting, and solves problems of holdup and contamination because adhesive substances won't stick to the "waxy" internal surface.

This unique combination of properties makes hose lined with TFE resin ideal for the toughest service conditions. And now, new constructions especially for industrial applications include fiber reinforcements, elastomeric coverings, convoluted tubing for greater flexibility, and a variety of industrial couplings.

Consult your dealer, or write: E. I. du Pont de Nemours & Co. (Inc.), Poly-chemicals Department, Room T-101019, Du Pont Bldg., Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Major producers count on DAY equipment to process solid propellant fuels

DAY builds equipment specifically designed to meet the exacting requirements for processing solid propellant fuels. The machine types shown here have been specified by major producers of solid fuels for their safe and efficient operation, ruggedness and thorough dependability.

Investigate the many proven advantages of DAY equipment for your processing work. You'll receive every benefit that more than 70 years of experience in building a variety of processing machinery can bring, plus DAY'S matchless reputation for reliability and service. Write for detailed information on DAY equipment to meet your requirements, or call in a J. H. Day Company field engineer.

The J. H. DAY Co.

Division of The Cleveland Automatic Machine Co

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MANUFACTURERS OF QUALITY MIXING, BLENDING, SIFTING, MILLING EQUIPMENT SINCE 1887



offer many special features for

processing solid propellants: Jacketed stainless steel tank; close temperature control; many safety features; provision for vacuum mixing; equipped for remote operation. Available in a complete range of laboratory and production sizes, 1/4 –300 gal. capacities, 3/4 to 150 h.p. drives. Write for Bulletin 1157.

DAY PONY MIXERS

twin or single motion, provide fast, thorough mixing of curing agents and high performance fuel additives Whatever your requirements, there's a DAY Pony Mixer specifically designed to do the job. Write for Bulletin 500.



DAY 3-ROLL MILLS

produce fine dispersions of fuel curing agents that were previously blended in DAY Pony Mixers. DAY Mills are built in 10" x 22" and 14" x 30" sizes for production quantities; in 5" x 12" and 4" x 8" sizes for pilot operations. Write for Bulletin 158.





DAY RIBBON BLENDERS provide fast, pre-blending of oxidizer grain sizes prior to final dispersion mixing of the composite fuel. Built in a wide range of rugged tank sizes and designs, with various types of agitators. Write for Bulletin 800.

DAY RO-BALL GYRATING SCREENS

use super-active ball cleaning principle to sift foreign materials from oxidizers and additives; to obtain selected grain sizes for burning rate control. Many models are available to provide from two to five separations, with choice of discharge designs. Write for Bulletin 957.





...another reason why Timken® stainless steel tubing gives you more for your money

HEN you need stainless steel pressure tubing for high temperature and pressure applications, take this wise step: Specify Timken® stainless pressure tubing. You will be sure of getting the finest quality available. One reason: Timken steel quality begins in our own melt shop. Another, our tubing gets "the white glove treatment" thru all manufacturing operations. For example, during white pickling, shown above, stainless steel straps hold the tubes to prevent damaging the surface. Excellent surface finish and high internal quality are assured in Timken stainless tubing because:

1. THE TIMKEN SEAMLESS tube mills are among the most modern and best-equipped anywhere.

2. WE PIONEERED the production of stainless steel tubing for pressure tube applications, and have developed numerous stainless and intermediate alloy steels for this purpose.

3. SPECIAL TECHNIQUES, some of them unique in

the steel industry, are used in producing Timken stainless pressure tubing.

Call in Timken Company metallurgical experts to help solve your stainless pressure tubing problems. And there's a wide variety of sizes and grades of tubing—some not available anywhere else. For the most for your money in steel, specify "Timken". The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.

WHEN YOU BUY TIMKEN STEEL YOU GET . . .

- Quality that's uniform from heat to heat, bar to bar, order to order
- 2. Service from the experts in specialty steels
- 3. Over 40 years experience in solving tough steel problems

TIME STEEL

TIMKEN ALLOY STEEL AND SEAMLESS TUBING IS AVAILABLE FROM STEEL SERVICE CENTERS IN 44 CITIES IN THE UNITED STATES

NEW HONEYWELL CATALOG

helps you choose the right

THERMOCOUPLE WELLS

Here's valuable help in the often-perplexing job of picking the right thermocouple wells and assemblies for particular applications.

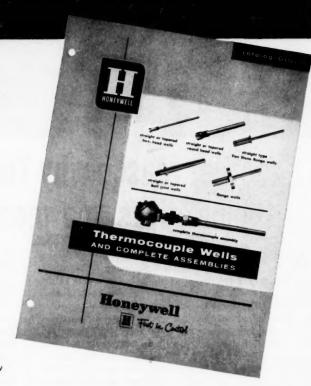
This new Honeywell catalog brings you a wealth of useful data... provides all the information you need to make the right selection every time. Included in the catalog are:

- Well designs and dimensions
- Pressure and temperature ratings
- Corrosion data
- Thermocouple assembly data
- Ordering and pricing information

Honeywell



First in Control



FILL OUT AND MAIL THE COUPON FOR YOUR COPY-NO OBLIGATION

MINNEAPOLIS-HONEYWELL Wayne and Windrim Avenues Philadelphia 44, Pa.

Please send me a copy of the new Thermocouple Wells Catalog G102-1.

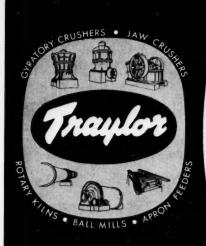
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Company

Address City Zone State

Traylor-made kilns leature Operating Econo Advance Design Rugged Dependa

Operating Economy Rugged Dependability



10'-0" diameter x 340'-0" Traylor Rotary Kiln in a Portland Cement plant.

> Traylor engineers have built hundreds of Rotary Kilns now being used in industry throughout the world. Traylor kiln shells are fabricated with quality steel plate. The full-floating type of tire with special mounting holding the tire in place but permitting it to float free of the shell as it contracts and expands is another reason why Traylor Kilns are your best buy. For details, ask for Traylor Bulletin No. 1115.



8'-0" x 150'-0" Rotary Kiln in a portland cement plant.



9'-6" dia. x 250'-0" Rotary Kiln in a portland cement plant.



12'-0" x 325'-0" Rotary Kiln in a chemical plant.

TRAYLOR ENGINEERING & MFG. CO.

1200 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

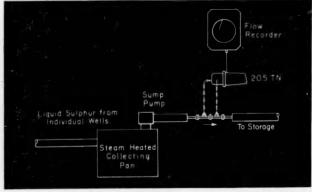
See our display at the Chem-Show booth #495 New York Coliseum, Nov. 30 to Dec. 4



205T Volumetric Differential Pressure Transmitter measuring molten sulphur flow at Freeport Sulphur Company's mines in Louisiana;



No pocketing . . . no purging . . . no plugging . . . with this low-cost transmitter designed for flow, level and differential pressure measurement.



Two all-welded stainless steel sensing diaphragms installed in the pipeline eliminate the need for steam tracing of the lead lines. Result—quicker, less expensive installation; negligible maintenance; process shut-down eliminated.

Freeport Sulphur Company saves time, money on molten sulphur flow control

Taylor Volumetric DP Transmitter costs less to install and maintain

The Taylor 205T Transmitter costs less to install because none of the steam jacketing and insulation needed for a conventional aneroid meter is required. There is no need to insulate leads or meter body, since sulphur comes in contact only with the pressure sensitive diaphragms located either side of the orifice plate in the pipeline.

It costs less to maintain since molten sulphur does not enter any portion of the instrument—no chance of corrosion, no costly clean-out necessary.

Utilizing the force-balance principle, coupled with sealed silicone-filled sensing systems, the 205T Transmitter is the ideal, economical way to eliminate purge and seal problems as well as costly steam tracing. Accurate, sturdy, dependable and low-cost, it can solve your most difficult flow and liquid level measurement problems.

Ask your Taylor Field Engineer for full details, or write for **Bulletin 98281.** Taylor Instrument Companies, Rochester, N.Y., or Toronto, Ont.

Taylor Instruments MEAN ACCURACY FIRST

GRINNELL REPORTS ON VALVES:

THE ADVANTAGES OF

GRINNELL-SAUNDERS DIAPHRAGM

11

HIGH-VACUUM SERVICE

Dependable performance and long service life for vacuums down to 0.1 micron . . . with leak rates of less than 0.1 micron cubic foot/hour

One of the most important requirements of valves for high-vacuum service is that they must be vacuum-tight at all times during their operating cycle. Diaphragm valves of the Grinnell-Saunders manufacture fully meet this requirement. When clamped between the flanges of the body and bonnet, the



Valve provides vacuum-tight seal in closed position

diaphragm is easily made vacuum-tight down to 0.1 micron — with an in-leakage rate of less than 0.1 micron cubic foot/hour. Whether in the open, throttling or closed position, the diaphragm presents a smooth, unbroken face to the vacuum side of the chamber.

Rugged, nylon-reinforced diaphragms in a variety of materials

Grinnell has perfected a method of reinforcing its diaphragms with wear-resistant nylon. The result is a diaphragm that lasts longer at high-vacuum. The only part of the valve subject to service wear at any time is the diaphragm — which can easily be replaced in a matter of minutes, without removing the valve body from the system. Diaphragms are available in a wide choice of materials.



Rugged, reinforced nylon diaphragm gives long-lasting life

Contamination minimized

Construction of Grinnell-Saunders Diaphrågm Valves provides separation of the working mechanism from the vacuum within the system. This isolation of lubricated working parts prevents contamination of the system from lubricant outgassing.

Large, unimped

The large pa valve, in the ope imum impedance dom moving m down to high-vac the pump-down of



In open position, valve p

Special provision

Sealed bonnet evacuation when type diaphragms uation of the bonn tic diaphragms, u peratures, do requ bonnet for long di

For more informa

Get further fa Saunders Diaphr how the diaphrstreamline flow in and how the dia against the body closure. Write to pany, Providence

VALVES

peded valve passage

e passage of the Grinnell e open position, offers mindance to the escape of raning molecules in pumping h-vacuum, thus shortening own cycle.



valve passage is free and unimpeded

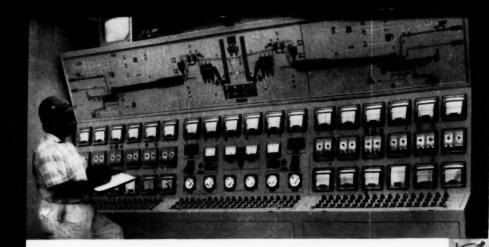
isions:

onnets are available for when required. Elastomer gms do not require evacbonnet. Valves with plasns, used at elevated temrequire evacuation of the ng diaphragm service life.

ormation

ter facts about Grinnelliaphragm Valves. Learn, aphragm lifts high for ow in either direction e diaphragm seals firmly body weir for leak-tight te to: — Grinnell Comence 1, Rhode Island.

an electronic control success story every process engineer will want to read...



Riverside's computer-controlled plant now on-stream with Foxboro Electronic Consotrols

pressures — temperatures — flows all electronically controlled

Giant, gas-fired cement kilns, 310' long, 10' and 12' in diameter — they're under complete Foxboro electronic control at Riverside Cement Company, Oro Grande, Calif. All process variables, including pressures, temperatures, motion, differential pressures, motor speeds, gas-analysis, and gas-air ratios are included in this fully co-ordinated instrument system.

Riverside's Electronic Consotrol* Instrumentation includes transmitters, controllers, recorders, converters, integrators, alarms — all solid-state — all linked by a common 10-50 ma, d-c signal. Transmission is over simple, unshielded lines. And this ultra-modern control system is fully compatible with process control computers.

Foxboro Electronic Consotrol Instrumentation is ideal for chemical plants, refineries, steel mills, nuclear reactors — wherever precise, rapid, long-distance control is required. Ask your local Foxboro Field Engineer about Electronic Consotrols — or write for Bulletin 21-10. The Foxboro Company, 3610 Neponset Avenue, Foxboro, Mass.

*Reg. U. S. Pat. Off.

AN ELECTRONIC CONSOTROL INSTRUMENT FOR EVERY CONT

Recorder

No amplifiers, slidewires, o servo motors. Operate completely independent of controller. 1 and 2-pen models with 4" vertical strip chart

Indicating Transmitters

Use any standard Foxboro measuring element — continue to measure and indicate even in event of power failure.

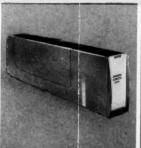
Electrical Converters

Convert EMF and Resistance measurements to a 10-50 ma, d-c signal. Rack or panel mounted. No batteries, no slidewires, no servos.

For measuren sure, absolu ferential pre Require no la











TROL LOOP FUNCTION

Transmitters

asurements such as pres-absolute pressure, dif-al pressure, and level. no local power supply.

Indicating Controllers
May be mounted individually or in same housing with recorder. Each operates and pulls out from panel — completely independent of the other.

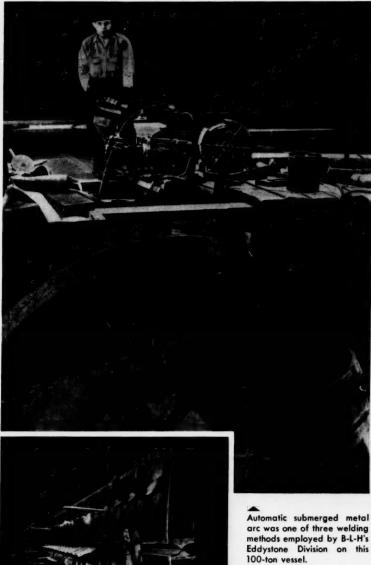
Typical application of Foxboro Electronic Consotrol Instrumentatio . . . Riverside Cement Company's modern plant at Oro Grande, Cali 310' kilns have all process variables under Foxboro electronic cortrol. Other major Foxboro electronic installations include petro chemical plants in the U.S. and Canada, nuclear reactors, as we as unattended booster stations on a 680-mile crude oil pipe line





FOXBORO

At B-L-H the proof of the welding is in the testing . . . X-rays of giant pressure vessel showed not one defect!



Automatic submerged metal

Chrome molybdenum steel 5 1/16 in, thick was carefully preheated prior to tackwelding. Shown is a profile of the joint, beveled by flame cutting between half-cylinders.

The 100-ton pressure vessel illustrated was fabricated at the B-L-H Eddystone Division by welding together two half-cylinders, 12 ft. long, 6 ft. in radius, and made of 5 1/16-in.thick chrome molybdenum steel. Then these had to be joined at top and bottom to hemispherical heads of the same material 25% in. thick. The ends of the cylinder walls had to be tapered from the outside so that the walls and heads would be of the same thickness at the joint. Joint design for the longitudinal welds called for 64 passes to be built up in a balanced manner, first on one side of the cylinder wall, then on the other, to avoid uneven stresses.

Welding several nozzles to the heads presented some unusual problems. One such weld required 92 passes. In all, 13 kinds of steel ranging from 3/8 in. to 5 1/16 in. in thickness were used.

All root passes, all joints that were back-chipped, and all completed welds were examined by magnetic particle inspection. Also, as a requirement of the job, all welds in the piping and the vessels were subjected to a 100% radiographic inspection with 1-curie sources of cobalt-60. At this point the care and precision with which the welding had been planned and executed became dramatically evident. No defects were found and no repair welding was necessary.

Only a shop with Baldwin's wealth of skills and facilities could have handled this tough job so efficiently ... so economically.

A copy of our illustrated Weldment Bulletin 7001 is yours for the asking.

BALDWIN · LIMA · HAMILTON

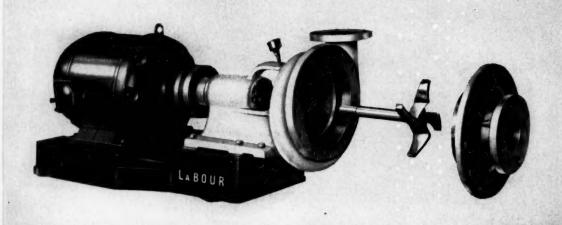
Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings • Diesel engines • Special machinery • Bending rolls • Ship propellers



AIR or VAPOR —The Factors That Won't Stay Put



Calculating pump pressures and capacities is fairly simple as long as you deal with factors that behave themselves. But when air enters the picture you can trade your slide rule for a crystal ball.

Of course a pump isn't supposed to have any air in it, but nevertheless at unpredictable times you get air or vapor in unpredictable quantities. When you do, your nice calculation of volume and specific gravity and viscosity goes out the window. All you can do is guess.

You can't escape the fact of air or vapor in what is supposed to be liquid, but you can play safe by specifying LaBour pumps. Even non-priming LaBours can handle air mixed with the liquid, and they do not air-bind in many situations which would make ordinary pumps inoperative. Ask us to give you all the interesting details.

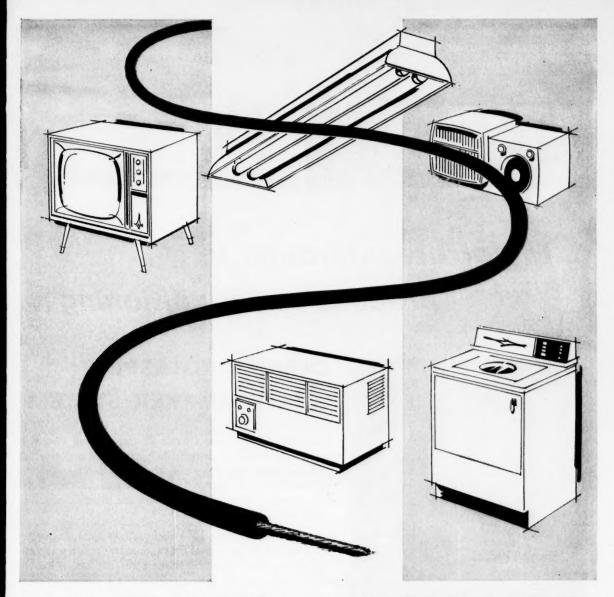
ORIGINAL MANUFACTURERS OF THE SELF PRIMING CENTRIFUGAL PUMP

LABOUR

S. A.

THE LOBOUR COMPANY, INC.

ELKHART, INDIANA, U.S.A.



TRIDECYL ALCOHOL

To make DTDP-new low cost plasticizer for high temperature vinyl insulation

Enjay Tridecyl Alcohol is a basic ingredient of ditridecyl phthalate (DTDP), a new high performance plasticizer developed by Enjay Laboratories. DTDP is ideally suited to the manufacture of high temperature vinyl insulation for the electrical industry. The use of this plasticizer will substantially reduce costs at no sacrifice in electrical and mechanical properties. Enjay does not make ditridecyl phthalate but supplies Tridecyl Alcohol for its manufacture.

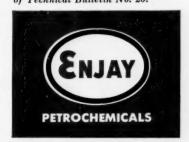
EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

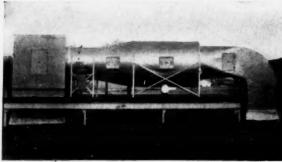
ENJAY COMPANY, INC.

15 West 51st Street, New York 19, N. Y.

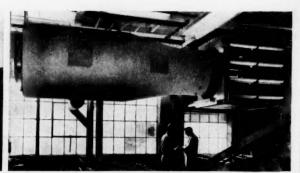
 $Akron \bullet Boston \bullet Charlotte \bullet Chicago \bullet Detroit \bullet Los\ Angeles \bullet New\ Orleans \bullet Tulsa$

For further information about Enjay Tridecyl Alcohol, write or call our nearest office for a copy of Technical Bulletin No. 20.



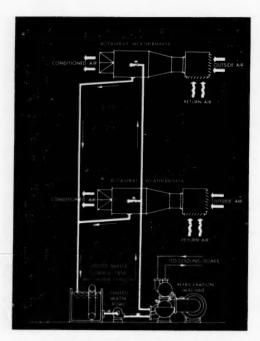


Roof-top Rotaspray installation



Ceiling-mounted installation

Major breakthrough in process air conditioning...



Rotaspray units are self-cleaning, and require no filters. A single refrigeration machine with chilled water storage tank and filter station will handle a multiple unit system with units located at many remote points. Each unit provides individual control of temperature and humidity.

CARRIER ROTASPRAY WEATHERMAKER SYSTEM*

This revolutionary new Carrier air conditioning system is now available to the chemical industry. Its superiority has been proved by four years of field operation on many different installations. Compared with past systems, it provides better control, it lowers construction and maintenance costs—and occupies less space.

Operating at high air velocity (2600 fpm) Rotaspray units are only $\frac{1}{3}$ as large as conventional air treating apparatus for the same capacity. Furthermore, they can be located out of doors, with no protective shelter. For system arrangement, note the diagram at left.

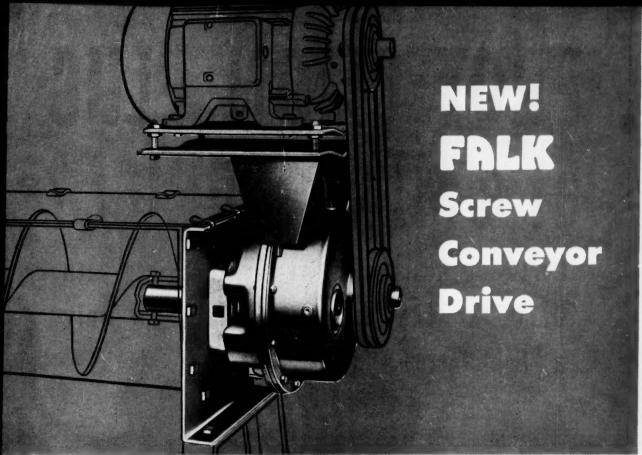
Each Rotaspray unit is made of stainless steel for long life. Each provides superior control of temperature and humidity, and offers unequaled ability to meet load variations in the area it serves. Units are compact and light, can be hung from the ceiling, put on the roof or suspended outside on the wall. Four sizes: 10,500 to 30,000 cfm.

For complete information on this new system, call the Carrier office near you. Or write Carrier Corporation, Syracuse, New York.

*Pat. Pending

MORE PROOF OF
BETTER AIR CONDITIONING FOR EVERYBODY

Carrier



U.S. and Foreign Patents Applied For

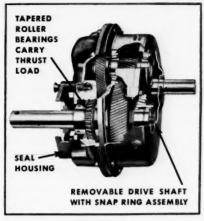
- the drive our customers asked for

Our customers helped us design this new unit. We sent our men into the field to find out what our customers needed in a screw conveyor drive—then our engineers designed a new drive that offers the maximum of service, versatility, operating economy and long life. Here are some of its outstanding features:

- A COMPLETE DRIVE: Saves engineering and assembly time. Six sizes to cover entire range—each with these ratios: 4:1, 9:1, 14:1 and 24:1. Bolts to any standard trough end—eliminates trough end bearing. Eliminates drive shaft wobble. Efficient FALK single helical gears.
- SEAL HOUSINGS: Choice of seals (neoprene or leather lip, felt or waste) to accommodate material conveyed. Space between trough seal and unit seal prevents conveyed material from reaching unit seal.
- REMOVABLE DRIVE SHAFT: Snap ring assembly permits easy removal. Five sizes, from 11/2" to 3%6".
- **TROUGH END:** Can be fastened to any standard trough. Eight sizes, from 6" to 20".
- ALL-STEEL MOTOR MOUNT: Saves costly engineering and installation time and costs; no motor plates to design or fabricate. Motor can be mounted in virtually any position. Pre-drilled to accommodate NEMA standard motors ½ to 30 HP.

AN IMPORTANT ECONOMY: Buy only what you need—the basic reducer alone, or with trough end and/or motor mount. For detailed information, contact your Falk Representative or Distributor—or write direct for Bulletin 7106.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN
MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS
Representatives and Distributors in most principal cities



FALK is a registered trademark



PROTECTION PLUS at a MINUS PRICE!

Corrosion Resistance Greatly Increased with DeZURIK PLASTIC-COATED VALVES at Only a Slight Increase in Price!

Mild corrosive services—such as alkalies, mild acids, sea water and other neutral salts—formerly required high-priced alloys in valves to resist corrosion.

Now, these and other similar services can be handled by a DeZurik Plastic-Coated Valve at a price only slightly higher than a cast iron valve.



The plastic coating of DeZurik Valves resists attack from mildly corrosive services and is particularly suited to the handling of de-ionized and de-mineralized water where iron contamination is objectionable.

Plastic-Coated DeZurik Valves eliminate the frequent replacement of low cost valves on systems where contamination or corrosion destroyed the valve in a short time, yet the use of more expensive high alloys was prohibitive. Now one valve, costing only slightly more than a cast iron valve, eliminates replacement valve costs, maintenance expense and down time!

Get more information from the DeZurik representative in your area, or write to Dept. P. C.



SULPHUR

Spotlighting the new TGS Recovery Plant at OKOTOKS



OKOTOKS marks another step in the steadily broadening service being developed by TGS for industries in the States and Canada. Production from OKOTOKS, sitting on top of the vast "sour gas" field a few miles south of Calgary, Alberta, will add a significant tonnage to the supplies of Sulphur already available through TGS to the expanding industries in the Pacific Northwest. OKOTOKS is set up to make shipments of Sulphur in solid or molten form.



TEXAS GULF SULPHUR COMPANY
75 East 45th Street, New York 17, N. Y.
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Sulphur Producing Units:

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PICKLED in a 4% brine solution!





CHOKED
in a tornado of abrasive dust!



FROZEN for weeks at 75° C below zero!



BURIED ALIVE in thick, sluggish mud!

nothing... but nothing stops Super-Seal open-type motors

Thanks to exclusive <u>Poxeal</u> and <u>Silco-Flex</u> insulations, <u>Super-Seal</u> motors have shown endurances that even enclosed motors couldn't match. Results and reasons available from your A-C representative or distributor. Or write General Products Division, Milwaukee 1, Wisconsin

ALLIS-CHALMERS



Poxeal, Silco-Flex and Super-Seal are Allis-Chalmers trademarks.



In this Split Wedge Gate

you can see why it pays to

Specify JENKINS for STAINLESS STEEL Valves, too

This picture shows the many points of excellence in the design and construction of Jenkins Fig. 1327 Split Wedge Stainless Steel Gate Valves. Compare them with any valve you know. You'll conclude that it's hard to beat Jenkins at making valves, no matter what the material.

But no picture can show the quality of the castings . . . the precision machining . . . the rigid inspection and testing that have gone into this valve. All of these are as important as design and metal alloys in assuring long, dependable, economical valve service. And, all of them are up to the peak standards for which Jenkins has been known for almost a century.

SEND FOR NEW CATALOG of Jenkins Stainless Steel Valves. You'll find in it the patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services. Also, you'll see that these Jenkins valves meet valve industry specifications and the high standards established by the leading users of stainless steel valves. Jenkins Bros., 100 Park Avenue, New York 17.

-WHEEL of high strength malleable iron designed for firm grip and easy operation. YOKE BUSHING, easily renewable.
Made of bronze, for ideal thread
engagement with stainless steel spindle, to prevent seizing or galling of spindle threads. Bushing of

stainless steel is optional. SPINDLE has long thread bearing surfaces with correct lead for easy, tight closing. Screws into wedge carrier, then secured by a stainless steel pin.

YOKE BONNET has liberal space between yoke arms for easy ac-cess to packing box. Precision machined flange face assures uni-form contact with gasket for a tight body-bonnet joint.

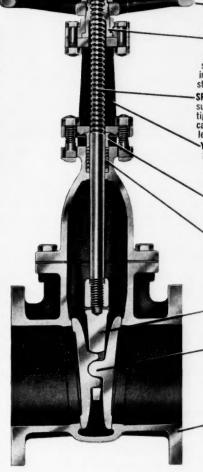
GLAND consists of two pieces — gland flange and gland follower — eliminates binding of follower in case gland bolts are tightened

PACKING of Chevron-type Teflon in large packing box prevents leak-age. Only a minimum load is required on gland, extending service life of packing.

WEDGE CARRIER connects wedge to spindle and raises or lowers it, Husky in size to stand any operat-

SPLIT WEDGE is the ball-and-socket design which automatically adjusts to the tapered seating surfaces for positive shutoff. The discs, revolving freely in the wedge carrier, produce a self-cleaning action on seating surfaces and reduce pos-sibility of galling and seizing.

BODY —Through-port design for full, free flow. Ample wall thickness and good design provide extra strength to withstand stresses. End flanges conform to M.S.S. specs.





Sold Through Leading Distributors Everywhere



JENKINS BROS., 100 Park Avenue, New York 17, N. Y.

Send the new stainless steel valve catalog

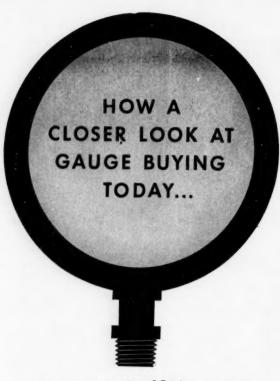
Have a representative call on me

NAME & TITLE

COMPANY

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CHEMICAL ENGINEERING—October 19, 1959



can save up to 40% on many pressure gauge applications

Analyzed your gauge needs lately-how much gauge performance you're getting, compared to what you need and what you pay for? Perhaps it's time for a closer look at United States Gauge with its line of 50,000 standard pressure gauges, plus specials (and all possible choices in case styles, sizes, materials and pressure ranges). For example, note how you can save up to 40% on premium gauges and still get premium performance with the USG A-Line (top, right). Note, too, how you can get the exact gauge for any need and cut waste of under - buying or "over-gauging" . . . from all the gauge lines available at this one source. Then check the USG distributor listed in your Yellow Pages. Or write direct for catalogs and name of your nearest distributor today.







Paying needless premium prices for reliability? USG A-Line pressure gauges have premium construction, save up to 40% on premium prices. Meet A.S.A. Grade A standards, including 1% accuracy. Extra rugged, they are built to deliver longer under severe operating conditions, where you do not require the accuracy of Grade AA gauges, but where reliability and cost-cutting are "musts". Wide choice of Bourdon tubes, case styles and sizes, pressure ranges, and movements. You must see the sturdy design and price to believe the value and performance. Models for general-purpose service, altitude, refrigeration, ammonia and hydraulic applications. Write for Catalog 305.

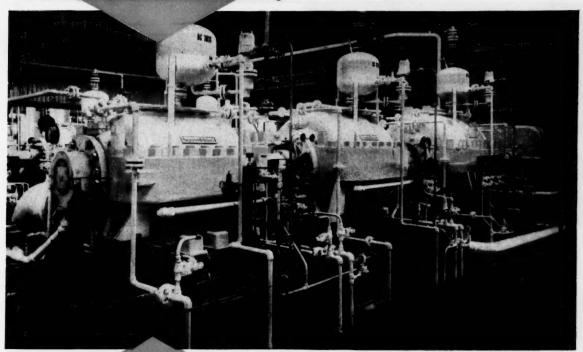


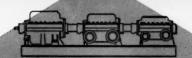
Buying too much gauge for your purpose? Save with volume-priced, precision-built USG Drawn Case Gauges for service where your gauge need calls for A.S.A. Grade B standards, including 2% accuracy. Write for Catalog 64A.



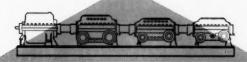
Getting all the accuracy you're paying for? You can't buy more precision than with USG Test Gauges which meet or exceed A.S.A. Grade AA standards, including accuracy as high as 0.2 of 1%. Write for Catalog 400.

Putting the PRESSURE on Ethylene Production...





Ethylene Refrigeration: Three multi-stage, horizontally split I-R centrifugal compressors, handling ethylene gas at 396 psig discharge, driven by 12,150 hp gas turbine.



Feed Gas: Four multi-stage, horizontally split I-R centrifugal units compressing 10,750 cfm of hydrocarbon feed gas to 525 psig discharge, driven by 12,150 hp gas turbine.



Propylene Refrigeration: One single-stage vertically split and one multi-stage horizontally split I-R centrifugal compressor handling 17,900 cfm at 265 psig discharge, driven by 12,150 hp gas turbine.

Three Trains of Ingersoll-Rand Centrifugal Compressors help P.C.I. boost ethylene output at Lake Charles plant

THE new plant of Petroleum Chemicals, Inc., at Lake Charles, La., can produce one hundred thousand tons of ethylene per year, making it one of the country's major sources of this vital component for the chemical and plastics industries. Built by the Lummus Company, this P.C.I. plant features the latest technology and equipment for ethylene production.

To handle the various pressures required, nine Ingersoll-Rand centrifugal compressors are installed in three trains, each with its own gas turbine drive. The installation for ethylene refrigeration, shown in the photo above, consists of three multi-stage, horizontally split centrifugal compressors. This and the other two multiple-unit installations, all under one roof, are diagramed at the left. All of these centrifugals are designed to permit a 50% increase in plant production.

P.C.I. facilities at Lake Charles and the adjoining Calcasieu Chemical Corporation's plant (built and operated by P.C.I.) also include two other I-R centrifugals, eleven I-R reciprocating compressors totaling more than 23,000 hp, two I-R Axi-compressors and ninety-two I-R centrifugal pumps.

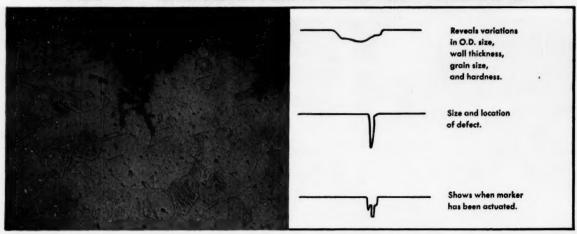
For information on equipment best suited to your compression requirements—centrifugal, reciprocating, axial-flow rotary or ejector—contact your nearest I-R engineer. Sizes and types range from vacuums of 5 microns to discharge pressures of 35,000 psi.



Ingersoll-Rand

COMPRESSORS . GAS & DIESEL ENGINES . PUMPS . AIR & ELECTRIC TOOLS . CONDENSERS . VACUUM EQUIPMENT . ROCK DRILLS

NEW DAMASCOPE TEST



This flaw is .004 square inches in area Damascope revealed exact size and location

FOR COMPLETE INFORMATION ON DAMASCOPE TESTING
Write today for four-page bulletin explaining operation and other pertinent data on Damascope inspection.

Here is a new and improved method of eddy current inspection that guarantees each and every piece of Damascus pressure tubing will meet your specifications. Damascope reveals not only the presence of flaws, but their exact size and location. Tubes with surface or sub-surface cracks, seams, splits, holes and inclusions are automatically indicated and rejected.

Over one million inspection feet were run to prove the new test which Damascus now employs as a regular production check on pressure tubing quality.

DAMASCOPE "Eddy Current" Test Meets ASTM Area Size Limits on Flaws

Gauge	Wall Thickness (in.)	Minor Dimension of Defect (Length or Depth) (in.)	Area Size Length x Depth (sq. in.)
20	0.035	0.005	0.0020
18	0.049	0.006	0.0024
17	0.058	0.007	0.0028
16	0.065	0.008	0.0032
15	0.072	0.009	0.0036
14	0.083	0.010	0.0040

Tubing passed by Damascope is guaranteed to meet A.S.T.M. specifications as outlined in the Book of Standards, Part 1, covering ferrous metals.

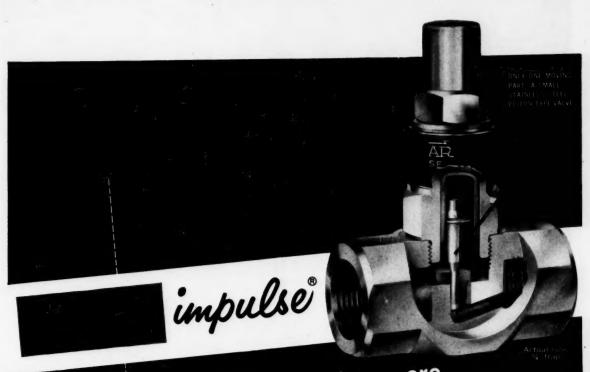
If you employ more stringent requirements, Damascope can be set to even finer sensitivity to yield a super tube at only a slight premium.

NUCLEAR APPLICATIONS

Damascope is one of the first eddy current methods of inspection to be approved for tubing used in critical nuclear work. It has been accepted because of the unique design of Damascope and because power surges previously responsible for variations in test criteria have been eliminated.



STAINLESS STEEL TUBING AND PIPE

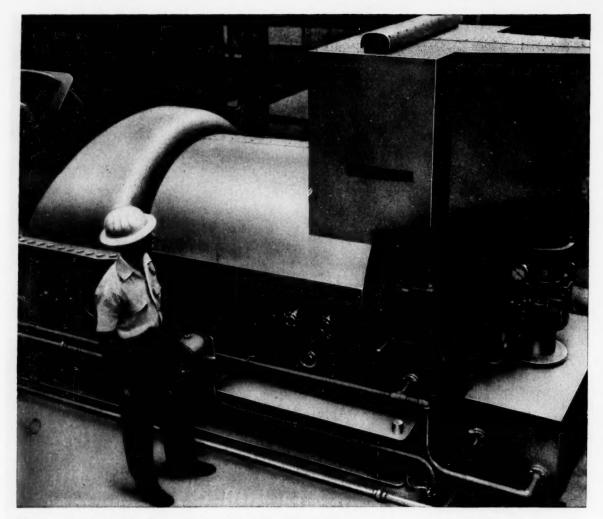


 \mathbf{Y} arway Impulse * Traps are the only steam traps that continually test for condensate in the line ahead of the trap and operate to discharge it as soon as it forms.

You gain by higher temperatures, steadier temperatures, peak operation of steam heated equipment at all times.

. A COMPLETE LINE OF STEAM TRAPS, ALL OPERATING ON A PROVEN THERMODYNAMIC PRINCIPLE

Manufactured by YARNALL-WARING CO., 125 Mermaid Avenue, Philadelphia 18, Pa.



Westinghouse multi-stage, hi-speed turbines guarantee you

... engineered power to meet your exact needs

Why pay for power you can't use? Or, by the same token, why strain a machine beyond its capability? Westing house can meet your exact turbine requirements with the world's broadest line of wheel sizes and design capabilities for steam conditions through 2400 psig—1050° F at the throttle, exhausting from 1 in.hg absolute to 300 psig.*

Fitting the right wheel size to the job is the key to efficiency and economy. By knowing your process re-quirements, cost of steam and number of hours you expect your turbine to run during the "payoff" period, we can provide the turbine design best suited to your

power and economic requirements.

To meet these varied requirements, Westinghouse has available five frame sizes of multi-stage, hi-speed turbines with wheel diameters ranging from 12 in. to 32 in. In addition, interchangeability of many wearing parts saves you money on inventories and stocking of spare parts.

Westinghouse turbine specialists located throughout the country are available at all times to provide personal attention to your heat balance problems, and are equipped to offer on-the-spot price and performance data for this entire turbine line. The capabilities of the

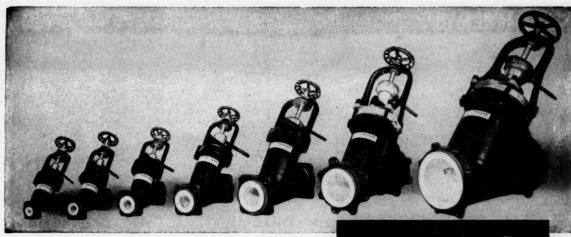
world's largest and most modern small turbine facility are at your disposal. Call your Westinghouse repre-sentative, or write Westinghouse Electric Corporation, Small Turbine Sales, Lester Branch Post Office, Philadelphia 13, Pennsylvania.

*WESTINGHOUSE MULTI-STAGE, MULTI-VALVE, HI-SPEED TURBINE FRAME CAPABILITIES

Turbine Frame Number of Stages	M-12	M-16	M-20 As Require	M-25	M-32
Wheel Size, in.	121/2	16	20	25	32
Maximum hp	4000	5000	7000	10,000	16,000
Maximum rpm	16,000	12,500	10,000	8000	6000
Maximum P, psig	1500	1500	1500	1500	1500
Maximum T, FTT	950	950	950	950	950
Maximum P ₃ , psig	300	300	300	300	50
Exhaust Size, in.	20	24	30	36	48
D. F. Exh. Size, in.	30	36	48	42 x 64 1/2	48 x 84
Max. Inlet Size, in.	5	6	8	10	12

(For special applications, inlet steam conditions to 2400 psig, 1050° F total temperature can be accommodated.)

YOU CAN BE SURE ... IF IT'S



LOW-COST SECURITY FOR YOUR CHEMICAL LINES...



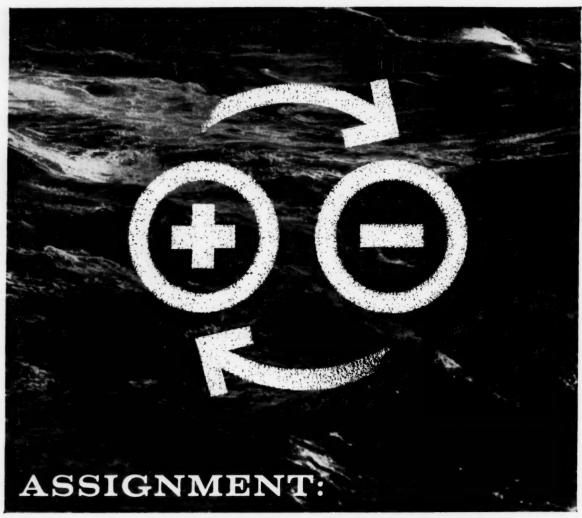
LAPP SOLID PORCELAIN VALVES WITH TUFCLAD®ARMOR

Install Lapp Solid Porcelain acid proof valves and have that trouble-free chemical line you want—at a cost well within budget. With Lapp Valves in your system, you have the assurance of purity, protection and permanence.

Because of its many special characteristics, Lapp Chemical Porcelain is the *ideal material* for maintaining *strict purity*. It is chemically inert, therefore resistant to corrosion from acids of all concentrations (except hydrofluoric); it's hard, dense, pure, homogeneous, close-grained and non-porous. Impregnated and bonded to this porcelain by an Epoxy resin of high strength and chemical resistance is an armor consisting of multiple layers of strong fiberglass. This serves as an insulator against thermal shock, a cushion to accidental impact and is strong enough to hold operating pressure even if porcelain is fractured. Built-in seating handle, solid Teflon packing, spring washers, malleable iron trim and brass stud and bushing are other advantages that make Lapp Valves well worth your investigation.



WRITE for description and specifications. Lapp Insulator Co., Inc., Process Equipment Division, 2208 Popular St., LeRoy, N. Y.



SALT WATER CORROSION

How Lukens Application Research can help you find the right steel plate for the job

Among other materials, our Application Engineering staff has studied the outstanding nickel alloy, Monel, in a variety of salt water applications. Monel is surprisingly economical when used in clad plate form—a Lukens specialty produced by bonding a layer of Monel to a tough, low-cost carbon steel backing plate.

The massive legs of off-shore radar platforms, for example, are protected by Lukens Monel-clad steel plate. Our engineers recommended this shielding for the critical splash areas extending above and below the water line. It has proved a most successful application.

Salt water swimming pools on ocean liners, traditionally of tile, often require extensive repair between voyages. We helped solve this problem for a well-known steamship line—again with Monel-clad steel plate. Beautiful to look at, these sea-going pools need only routine cleaning and maintenance. Many are now in service—others are being built, including one for the nuclear powered Savannah.

If your assignment is salt water corrosion, let it be our assignment, too. Lukens Application Engineers have documented cases covering a wide range of materials selection problems—to help you choose the right steel plate.

Contact Manager, Application Engineering, H109 Services Building, Lukens Steel Company, Coatesville, Pa.

Helping Industry Choose Steels That Fit The Job



ASK FOR THE BULLETIN ON LUKENS CLAD STEELS

SERIES

AMPERES

10B

1.75

20 116- 117- 126- 236 136- 1256C H-C 3.0 7.5 10.0 12.5 20.0 45.0 200 and up

the NEW 10B
SERIES

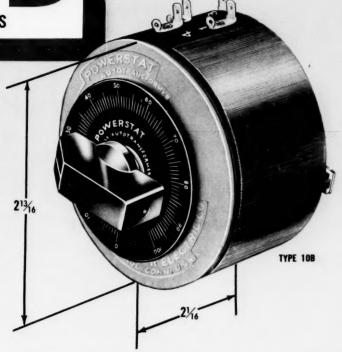
POWERSTAT® variable transformers

40% INCREASE IN RATING.

NO INCREASE IN PRICE!

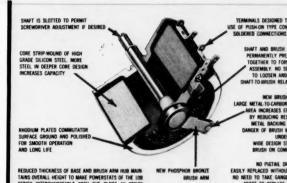
NO INCREASE IN SIZE!

POWERSTATS of the new 10B Series incorporate the most up-to-date variable transformer design refinements to provide the highest ratings and performance characteristics in their price and size range. Separate ratings are given for constant-impedance and constant-current loads to permit maximum utilization of the POWERSTAT. Features include a rhodium-plated commutator surface and space-saving core and coil design. Ruggedly constructed for long life and dependable service. Two- and three-gang assemblies are available for increased ratings and three-phase operation.



RATING CHART

IN	INPUT OUTPUT					1	
VOLTS	CYCLES	VOLTS			CONSTANT IMPEDANCE LOAD MAX. AMPS. MAX. KVA		
SINGL	E PHASE						
120 120	50/60 60	0-120 0-132	1.75 1.75	.21 .23	2.5 1.75	:30 :23 }	10B
240 240	50/60 60	0-240 0-264	1.75 1.75	.42 .46	2.5 1.75	:60 :46 }	10B-2
THREE	PHASE						
120 120	50/60 60	0-120 0-132	1.75 1.75	.36 .40	2.5 1.75	.52)	10B-2
240	60	0-240	1.75	.73	2.5	1.0	10B-3





THE

SUPERIOR ELECTRIC COMPANY

Bristol, Connecticut, U.S.A.



ADAPTER KITS are available for mounting potentiometers, rheostats, tap switches and other devices to operate in unison with POWERSTAT type 10B. If desired, complete assemblies are furnished with the device already mounted.

SERIES	108	20	116- 216	117- 217
AMPERES	1.75	3.0	7.5 3.0	10.0

126-226

12.5/6.0

136- 236	1156C- 1256C	H-C
20.0	45.0 28.0	200 and up

the NEW



126-226

SERIES

POWERSTAT®

variable transformers

For control applications having

- ... up to 12.5 amperes constant-current loads
- ... up to 18.0 amperes constant-impedance loads





TYPE 1

This all-new series rounds out the complete POWERSTAT variable transformer line. The 126-226 series offers open, enclosed, fused, cord-plug and enclosed terminal models; single, two- and three-gang types; manually operated and 5, 15, 30 or 60 second motor-driven assemblies — all available in a new, compact functional design. They incorporate the characteristics inherent in every POWERSTAT: zero wave-form distortion, excellent regulation, high efficiency, conservative ratings, smooth control and linear output voltage.

RATING CHART

IN	PUT	1		OUT	PUT		1
VOLTS	CYCLES	VOLTS		RRENT LOAD MAX. KVA	CONSTANT IMPI	MAX. KVA	TYPE
SINGL	PHASE						
120 120	50/60 50/60	0-120 0-140	12.5 12.5	1.5 1.8	18.0 12.5	2.2	126
240 240	50/60 50/60	0-240 0-280	6.0 6.0	1.4 1.7	9.0 6.0	2.2	226
240 240	50/60 50/60	0-240 0-280	12.5 12.5	3.0 3.5	18.0 12.5	4.3 3.5 }	126-2
480 480	50/60 50/60	0-480 0-560	6.0 6.0	2.9 3.4	9.0 6.0	3.4	226-2
THREE 120	PHASE 50/60	0-120	12.5	2.6	18.0	3.7	126-2
120 240 240	50/60 50/60 50/60	0-140 0-240 0-280	12.5 6.0 6.0	3.0 2.5 2.9	12.5 9.0 6.0	3.0 }	226-2
240 240 240	50/60	0-240	12.5 12.5	5.2 6.1	18.0 12.5	7.5 6.1	126-3
480 480	50/60 60	0-480 0-560	6.0 6.0	5.0 5.8	9.0 6.0	7.5 5.8)	226-3

RHODIUM PLATED COMMUTATOR
SUBFACE GROUND AND POLISHED
FOR SMOOTH OPERATION AND
LONG LIFE

CORE STRIP WOUND
OF HIGH GRADE
SILICON STEEL

WIDE BASE FLAME FOR
ADDED STABILITY. TWO STATS
OF MOUNTING HOLES TO SIJIT
NEW OIF EXISTING LAYOUTS

PROVINCE SMOOTH, QUIET TURNING,
MORE DEPENDABLE SERVICE, LONGER LIFE

SOLID METAL SHAFF CUICKLY ADJUSTED TO
ALLOW ETHER BENCH OR BACK OF PAREL MOUNTING
FROM STEEL

TERMINALS

COMMECTIONS.

THE SUPERIOR ELECTRIC COMPANY, Bristol, Connecticut Please send:

POWERSTAT Bulletin on 108 Series.

POWERSTAT Bulletin on 126-226 Series. Please have your representative call

name

company

address

city

one state

... FOR YOUR FILES

Request 108 Series Bulletin and 126-226 Series Bulletin giving full technical information, ratings and specifications.





THE SUPERIOR ELECTRIC COMPANY

Bristol, Connecticut, U.S.A.

SE-L8591

News and Notes on...

Good Packing Practice



Maintenance and Design Hints from Johns-Manville Packings and Textiles Dept.

Subject of the month: Trouble-shooting Packing Problems

Question:

ance of equipment.

How can you pinpoint the cause of a premature failure?

If you carefully examine used packing, a correct interpretation of the damage will often suggest exactly what caused a premature failure.

Generally speaking, the reasons fall into three areas: (a) the wrong size or style packing was selected for the particular service conditions, (b) the packing was not properly installed, or (c) the equipment requires maintenance. And any of these three conditions can not only result in premature packing failure . . . but can lead to other headaches resulting from poor perform-

Let us review some of the most common types of packing failures and their causes . . . easy to recognize through a careful inspection of the damaged packing.

1. Damage: Excessive reductions in the cross-section of the packing.

Possible cause: Bearing worn, or other shaft misalignment result in eccentric movement such as shaft "whip."

2. Damage: Wearing face of the rings dried and charred, but the rest of the packing is still in good condition.

Possible Cause: Either lack of proper lubrication, or the packing was not designed to withstand speed of movement involved, or the temperature range of service encountered.



J-M #7 Centripac® Packing shown here is designed specifically for single-stage centrifugal pumps in the process industries. Speeds to 3600 rpm; temperature to 500F.

3. Damage: One or more rings missing from set.

Possible Cause: Bottom of the stuffing box is badly worn, and allows the packing to extrude into the system, causing possible contamination.

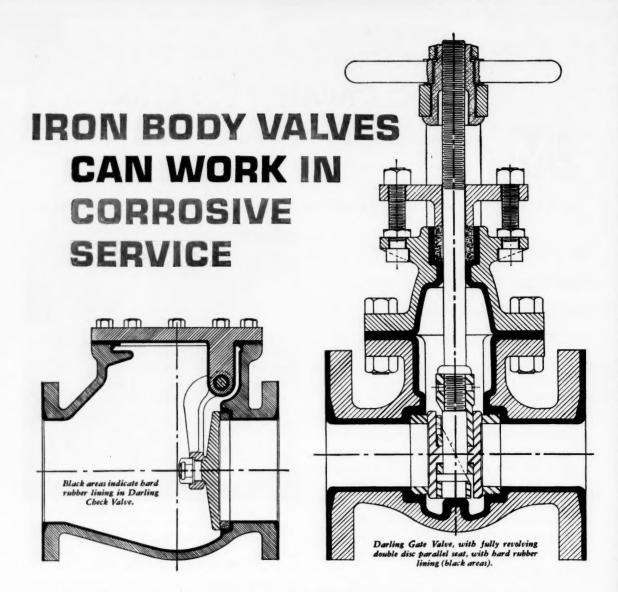
4. Damage: Wear on outside diameter of the packing.

Possible Cause: Rings rotating with the shaft, or coming loose in the box. Choosing the correct size of packing will eliminate this problem.



To solve any sealing problem, call on your local J-M Packing Distributor or Johns-Manville representative. They are equipped to help you select the right packing for the job—one that insures long, trouble-free service. For information, write to Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE



Rubber-Lined Check Valves...Gate Valves

Here's a way to make substantial savings in valves for corrosive or abrasive service. Darling Iron Body Check Valves and Gate Valves may be obtained with special hard rubber linings. This means you can often save the cost of expensive special alloy valves, yet obtain high resistance to corrosion or abrasion.

Darling Check Valves employ a streamlined body design especially selected for application of hard rubber lining. Excess area through the valve minimizes abrasion and insures full delivery of line capacity.

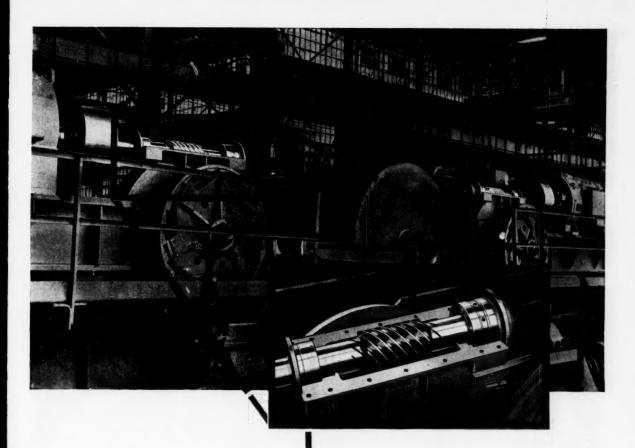
Darling Rubber-Lined Gate Valves give you the advantages of the revolving double disc parallel seat and "no pocket" discs... which provide positive sealing and assure ease of operation. Available in outside screw and yoke type, in sizes from 2" to 24". Write for further information.

DARLING VALVE & MANUFACTURING CO.

Williamsport 3, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.





for built-in OEM drives, Cleveland custom components save space, give smoother operation

By using standardized or custom-built Cleveland Worms & Gears, machine designers overcome the frequently troublesome problem of economically providing a quiet and efficient drive in a limited space. Cleveland components are available not only in standard sets but also in special sizes and ratios. Our wide range of special worm gear production equipment places us in an unparalleled position to furnish worms and gears of special designs. We maintain a complete and perpetual master worm and hob inventory that enables ready duplication of any Cleveland worm and gear ever made.

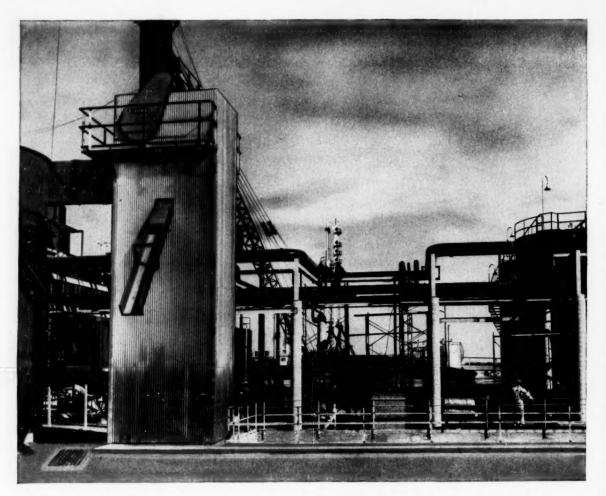
Our engineering specialists will gladly give you complete information on any application where specialized worm gear know-how is required. Call them today—they're as near as your phone. Or write for Catalog 201F—it gives complete data on built-in Cleveland Worms and Gears.

The Cleveland Worm & Gear Company 3275 East 80th St., Cleveland 4, Ohio

A subsidiary of Eaton Manufacturing Company

Affiliate: The Farval Corporation





Jeffrey system recovers coke fines at Skelly refinery

Petroleum coke, manufactured from reduced crude oil, is an important by-product at this new Skelly Oil Company refinery—important enough to justify recovering the fines dropped when railroad cars are loaded with the material.

The $\frac{1}{2}$ " x 0 coke fines, weighing 50 pounds per cubic foot, are washed up in water, which then pass through a settling tank. As the fines drop to the bottom of the tank, a continuous V Bucket Collector removes the fines, conveys and elevates them at rates up to $6\frac{1}{2}$ tons per hour.

Jeffrey designed and built this recovery system, drawing on its broad experience in treatment of water, sewage, and industrial waste. If you have a similar problem, where valuable materials can be recovered, contact Jeffrey. The Jeffrey Manufacturing Company, 909 North Fourth Street, Columbus 16, Ohio.



Jeffrey V Bucket Collector recovers coke fines from settling tank at Skelly Oil Company refinery, El Dorado, Kansas. The system also permits re-use of the water.



The TRUTH About

Chemical Engineering Subscribers

How many th	nere are				
	Total Paid Subscription Ci	rculation for the M	lay 4, 1959	issue 4	7,006
What their tit	tles are				
	Companies & Officials Works Executives Foremen, Supervisors, etc. Engineers Research Directors & Chief Chemis Other Chemists & Metallurgists Sales & Advertising Personnel Other Employees Independent Laboratories	3,156 Pi 2,396 Fi 15,448 C 1,955 N 1,015 Li 786 M	rofessors & Instringuical	lesalers vuctors students	614 814 248 2,829 787 102 239 560 211
Where they a	re				
	Maine 100 New Hampshire 76 Vermont 18 Massachusetts 1,417 Rhode Island 134 Connecticut 752 New York 5,020 New Jersey 3,315 Pennsylvania 3,303 Ohio 2,682 Indiana 729 Illiinois 2,065 Michigan 1,471 Wisconsin 488 Minnesota 462 Iowa 259 Missouri 965 North Dakota 22 South Dakota 22	Kansas Delaware Maryland District of Columbia Virginia West Virginia North Carolina South Carolina Georgia Kentucky Tennessee Alabama Mississippi Arkansas Louisiana	289 766 651 193 643 803 306 301 421 497 389 771 465 138 141 839	Montana Idaho Wyoming Colorado New Mexico Arizona Utah Nevada Alaska Washington Oregon California Hawaii U. S. Possessions & Other Areas Canada Foreign Miscelluneous	70 406 196 148 290 116 10 612 184 3,530 70

Source: Publisher's Statement for six months period ending June 30, 1959

The figures above are of considerable importance to us . . . and to our advertisers and readers.

That these breakdowns are a true reflection of our subscriber lists will be attested by the Audit Bureau of Circulations. ABC is a voluntary, cooperative and non-profit association of publishers and advertising men, which sets standards for the definition and measurement of paid circulation. At least once a year, ABC's highly trained auditors come into our Circulation Department. Several weeks later, when they leave, they prepare and distribute a detailed, accurate, verified count of all who pay to receive Chemical Engineering.

Established when there were no accepted standards of circulation value, ABC has helped honest publishers disprove the often-exaggerated circulation claims of unethical competitors. Naturally, this is of great value to the advertiser trying to reach a specific, defined group in a market. But it is also of great benefit to the reader.

Detailed ABC audits have proved an effective yardstick for measuring editorial vitality. By opening the complete record of a publication's success or failure in winning and holding paying customers, ABC reveals the fields' judgment of the editors' efforts and progress. Naturally, this stimulates editors of ABC-audited publications to be especially responsive to reader needs and particularly alert to ways to meet them.

This is one reason why CHEMICAL ENGINEERING editors survey 1,000 readers per month to learn their needs and wants; study reader reactions obtained through extensive field interviews; and take numerous trips into industry plants and offices to talk to readers. "Serving the reader better" is also the reason why CHEMICAL ENGINEERING has more engineers on its publishing staff than all other Chemical Process Industries technical publications put together.

The result: More engineers subscribe to CHEMICAL ENGINEERING than to any other publication serving the Chemical Process Industries. And thanks to ABC we can prove it!





low B&W JOB-MATCHED TUBING

saves in oil heater applications

- ... A complete range of carbon, alloy and stainless steels—permits choice of steel to match service conditions.
- ... A wide size range—provides for freedom of design.
- ... Uniform dimensions and mechanical properties helps to provide ease of fabrication.

These are just a few of the reasons it pays to specify B&W Job-Matched Seamless Pressure Tubing. Call the tubing specialist at your local B&W District Sales Office, or write for Bulletin TB-417 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

Chemical Show • Booth 1002 Coliseum • New York November 30-December 4



82

THE BABCOCK & WILCOX COMPANY

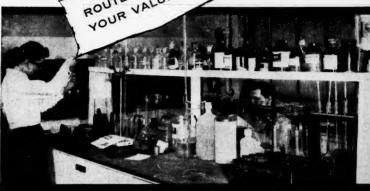
TUBULAR PRODUCTS DIVISION

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

WAUKESHA FOUNDRY RESEARCH

MAY WELL PROVIDE THE
ANSWERS TO YOUR PROBLEMS
IN CORROSION RESISTANT





WAUKESHA FOUNDRY has one of the country's most completely equipped metallurgical and research laboratories to work for you on your corrosion-resistant metallurgical problems. Moreover, WAUKESHA FOUNDRY also provides a group of metal formulations that may completely meet your requirements in bearing or wearing qualities, corrosion, hardness or working temperatures. Here they are:

STAINLESS STEEL. 5 types. Martensitic for maximum hardness... Ferritic for use where exposed to atmosphere, water or for scale resistance... Austenitic (including the 18-8 alloys) which can be welded without subsequent heat treatment

In addition there is WAUKESHA METAL — a copper base, high nickel content, solid, white, highly corrosion resistant alloy. 12 WAUKESHA METAL formulations are available. Please write giving your requirements and we will make specific recommendations.

PRODUCTION facilities. WAUKESHA is the largest jobbing foundry casting exclusively in alloy castings, yet facilities and versatility are such that one casting or a long production run is welcome.

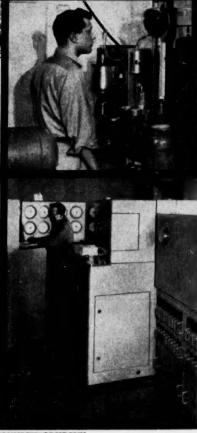
Write ... or please use the coupon below if more convenient.



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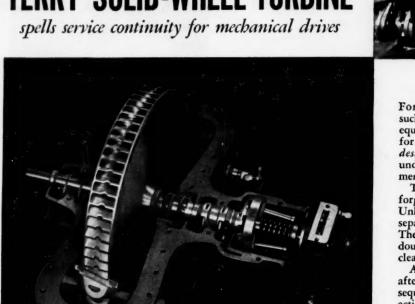


WAUKESHA FOUNDRY COMPANY
5905 Lincoln Avenue, Waukesha, Wisconsin

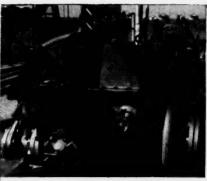
Please send your new technical Bulletin on Waukesha Metals and on Waukesha Stainless Steel Castings.

NAM	E	
TITLE		
FIRM		
ADDR	ESS	
CITY	STATE	**************************
		0023

TERRY SOLID-WHEEL TURBINE







For mechanical-drive applications, such as these, you will never find the equal of Terry solid-wheel turbines for built-in dependability. They are designed for trouble-free operation under the toughest service requirements.

The wheel, for example, is a single forging of special composition steel. Unlike a built-up wheel, there are no separate parts to loosen or work out. The blades can't foul since they are double-rim protected...with one-inch clearances at either side.

Any blade wear, which might occur after years of service, is of little consequence. As the power-producing action of the steam takes place on the curved surfaces at the backs of the buckets, wear does not materially

affect horsepower or efficiency.

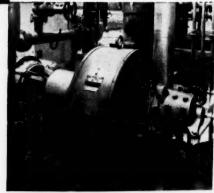
Specify Terry solid-wheel turbines for your next mechanical drives. They are available in capacities from 5 to 2,000 hp., speeds up to 10,000 rpm. Vertical turbines are built in sizes from 5 to 300 hp.

For full information about these reliable turbines, send for bulletin

THE TERRY STEAM TURBINE CO. TERRY SQUARE, HARTFORD 1, CONN.



TT-1216



WILLIAMS ROLLER MILLS

Quality Fine Grinding...
 20 Mesh To 400 Mesh...
 Micron Sizes On Some
 Materials

EXCLUSIVE GEARLESS AND SPUR GEAR DRIVES

Another Williams advancement! Cutaway shows Type D Mill with Spinner Air Separator with spur gear and pinion drive used on Standard and larger models. Smaller sizes have simplegearless V-belt drive which is easier to maintain than bevel gear drive—cuts labor and downtime.

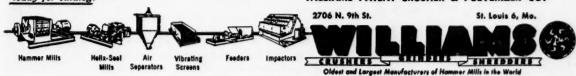
Bearing alignment of central shaft is simplified with only 2 bearings, the bottom one carrying thrust as well as radical load.

NOTE FLOW OF MATERIAL being ground by rolls rotating against bull ring, then air-swept to separator which discharges finished product while returning coarse tailings for regrinding.

From raw material to finished product—completely automatic grinding, blending and precision classifying to 20 mesh or micron size!

Self-adjusting feed rate...instant adjustment for sizing, even while mill is in motion... continuous automatic take-up to compensate for wear... constant rising air current to prevent build-up of fines and inefficient operation... automatically controlled hot-air drying during grinding of moisture-carrying materials... all are features of Williams Roller Mills that virtually guarantee increased output, surprising cost reductions and exceptionally high uniform quality. Get all the facts immediately... Write today for catalog.

WILLIAMS PATENT CRUSHER & PULVERIZER CO.





CP108-1

Chemical and petroleum division

BAILEY METER COMPANY

1054 IVANHOE ROAD . CLEVELAND 10, OHIO

In Canada-Balley Meter Company Limited, Montreal





RECOMMENDED USAGES ...

Stockham's new "O-Seal" is recommended for all general services - air, gas, water, steam, propane, hydrocarbons, etc., as well as for hard-to-hold services. Recommended for temperatures from minus 300 F to 400 F and not exceeding 720 psi. . Available in carbon and alloy steels, 2' to 12' sizes, 150 and 300 lb. pressures. Three port openings-40%, 70%, full round. Wrench, handwheel, gear, and motor operated.

Stockham makes a BETTER valve . . . for EVERY job!

Why is Stockham's new Wedgeplug "O-Seal" valve the hottest thing in the industry? Because it solves your leakage and lubrication problems-for good! It's non-

Two Teflon ** "O" rings, inserted in dovetail grooves machined on the face of the plug, seat on the raised body seats when the plug is in closed position. The sealing effect of these rings gives absolute shut-off in all cases-shut-off that remains permanently "bubble-tight."

Hundreds of tests of this new valve in all types of services have failed to make it leak. And it never needs lubrication!

OTHER ADVANTAGES

Provides Double-Block and Bleed in most services . Ends costly maintenance . Double seating for double safety. Ground metal-to-metal seat provides shut-off in case fire burns out "O" rings . Ends product contamination . Protected seats . Quick, easy operation-won't stick or bind.





The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts. No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

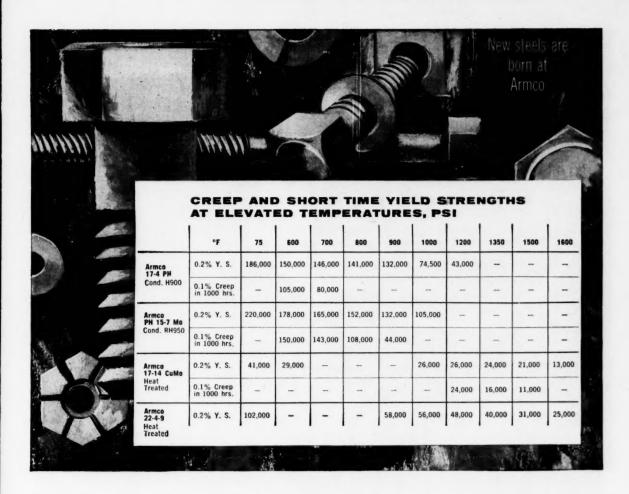
Saves floor space.

Desired delivery temperature Automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage. HANAREO DE PRETEORO POR COMENTANTO DE COMENTANTO DE COMENCIA DE COMENCIA DE COMENCIA DE COMENCIA DE COMENCIA D

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.



GET TROUBLE-FREE HIGH TEMPERATURE BOLTING with Armco's Special Stainless Steels

These elevated-temperature properties of Armco 17-4 PH, PH 15-7 Mo, 17-14 Cu Mo and 22-4-9 briefly but graphically demonstrate the utility of these special stainless steels for bolting as well as parts of mechanical and processing equipment that must withstand heat, high stresses and corrosion.

In addition to their desirable mechanical properties, Armco's Special Stainless Steels provide a useful range of design advantages such as high "hot" hardness, a choice of coefficients of thermal expansion and good fabricating characteristics.

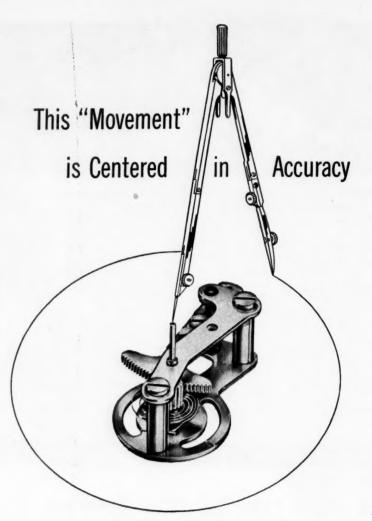
Get more information on these economical Armco grades and evaluate their usefulness in solving material problems imposed by high heat and pressure. Just fill out and mail the coupon.

ARMCO STEEL CORPORATION,		St., Middletown, Ohio 17-4 PH Stainless
Send me Product Data Bulletins on	☐ Armco	PH 15-7 Mo Stainless 17-14 Cu Mo Stainless 22-4-9 Stainless
We are considering it for	•	
FIRM		
STREET		
CITY	ZONE	STATE

ARMCO STEEL



Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation •



The rotary movement in Ashcroft Duragauges has a geared center shaft on which the pointer is mounted. When pressure flexes the Bourdon tube, the pointer is always positively positioned. You can rely on the Duragauge for precise accuracy in measuring pressure no matter how severe the conditions of service.

Correct calibration is guaranteed: the one-piece link between movement and Bourdon tube prevents slippage or parting under tension. Recalibration is easy

from front or rear. Universal adjustability permits uniformly graduated dials.

You can order Ashcroft Duragauges with all-stainlesssteel movement or stainless steel with nylon bearings and pinion gear. A complete choice of Bourdon tube materials, pressure ranges, dial sizes and case designs and materials is available. Your industrial supply distributor will gladly help you select the best combination for your requirements. So, be certain of highest sustained accuracy, durability and economy — specify Ashcroft Duragauges.



Ashcroft Duragauge in Alumalife® case—a lifetime case made of special aluminum alloy.



ASHCROFT PRESSURE GAUGES A product of MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario



Highly corrosive elements in processing system at Chemical Contour plant in Gardena, California, cannot harm this all-Penton ball valve (inset). A complete line of Penton valves is available from Chemtrol, Lynwood, California.

PENTON* handles jobs no metal can touch

Another example of the type of anticorrosion job that Penton does best is in the new process of chemical milling. In the heart of this processing system there's a Penton valve that has now been in operation for more than 10 months with no sign of failure. Installed in the drain line of a chemical milling tank, this Chemtrol ball valve is continually exposed to a 160°F. solution of concentrated nitric and hydrochloric acids with dissolved chloride salts and oxides. This bath is formulated specifically to eat away stainless steel, and the corrosive effect of these hot acids is apparent in the metal fittings surrounding the valve. But they haven't

affected this all-Penton Chemtrol valve. It still looks and works like new-inside and out.

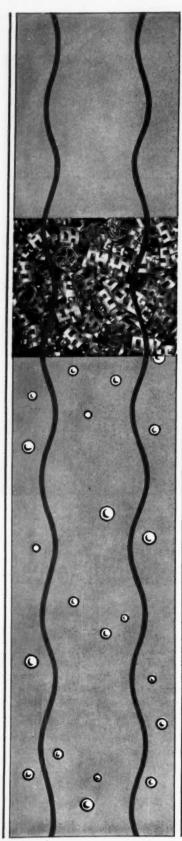
Penton outperforms other plastics, and even expensive metals, in many corrosive exposures involving high-working pressures and elevated temperatures. Now not only valves, but many other components for chemical processing systems are readily available. Pump parts, pipe, tubing, pipe fittings, and meter parts made with Penton permit the design of a complete Penton package for economical and efficient processing.

Why not look to Penton for the solution to your corrosion problems. For additional information, call or write:

*Penton is the Hercules registered trademark for chlorinated polyether.

Cellulose Products Department HERCULES POWDER COMPANY NECORPORATED CP69-17





METAL PALL RINGS OFFER SIMPLE, EFFECTIVE AND SUSTAINED CONTROL OF LIQUID ENTRAINMENT

One of the least expensive, yet one of the most effective ways to minimize liquid entrainment is through the use of metal Pall Rings.*

A dumped section of Pall Rings one or two sizes smaller than the rings in the bed will effectively capture the entrained liquid with negligible effect on the pressure drop within the tower. Often a section no deeper than 6" will be adequate. Some commercial tray scrubbers employ but a few inches of packing to prevent carry-over.

The unique shape of the Pall Ring, with its wall sections stamped and bent inward, offers these important advantages as a mist eliminator:

- 1. Lowest pressure drop
- 2. Freedom from fouling and plugging
- 3. More impingements per unit time
- 4. Maintained free space (95% or better)
- 5. High working velocities without re-entrainment
- 6. Easy installation

Metal Pall Rings are available in 5%", 1", 1½" and 2" sizes in carbon steel, stainless steel, nickel, monel, inconel, titanium, copper and aluminum.





 Are you on our mailing list to receive new technical releases from our experimental laboratories on packed tower performance? If not, drop us a note on your letterhead. No cost. No obligation. Address Dept. CE-1059, The U. S. Stoneware Co., Akron 9, Ohio.

*Pfannmuller, W., TRANS. INST'N. CHEM. ENGRS., Vol. 32, 1954, Supplement, pp.151 ff. Eckert, J. S., et al., CHEMICAL ENGINEERING PROCESS, Jan. 1958, pp. 70 ff.

11-G

DEVELOPMENTS ...

OCTOBER 19, 1959

Chementator

T. P. FORBATH

Shell Chemical heads into polystyrene with its own process but another's plant. American Cyanamid will produce thermoplastic for Shell in its idle methyl styrene facility at Wallingford, Conn.

Japanese company will be next commercial polycarbonate producer. New firm, Teijin Chemical, expects to beat GE and Mobay on stream with its \$2.3-million, 5-ton/day plant at Hiroshima.

Four eastern utilities are sizing up possibility of pumping West Virginia coal slurry to their steam plants through 24-in. pipeline. Pittsburgh Consolidation Coal would supply coal; Texas Eastern Transmission would build, operate facility.

International Atomic Energy Agency becomes more than a paper group. It has been called in to handle Austria-U. S. deal for 6 kg. 95% U-235 Al-clad fuel elements for Austria's Seibersdorf reactor.

Low-grade phosphates for fertilizer?

A grand-scale try at rendering low-grade phosphate rock amenable to fertilizer and animal-feed manufacture is shaping up south of the border. Mexico's Mining Development Commission is building a \$1-million rock-upgrading plant at Saltillo to tap Coahuila State's 25-million-ton deposit of $18\text{-}20\%\ P_2O_5$ phosphate rock.

With "hundreds of millions of tons" of such low-grade rock reserves in the country, Mexico is aching to free itself of the over \$7-million bill it pays for import of 50,000 tons of Florida rock each year. Plant under construction will upgrade 40,000 tons/yr. of Mexican rock to 28-30% P₂O₅ content, a material suitable for nitric or sulfuric acid processing into calcium phosphate fertilizers and feed.

Dreams of exploiting native low-grade rock deposits have danced before the eyes of at least three other nations dependent on foreign sources. Japan's rock-upgrading work proved unable to compete with imported material. A semi-works plant in the country was shut down recently. But Israel and Jordan reportedly are building plants to utilize their phosphate reserve, confident that the economics are on their side.

Mexico's belief that it can turn the upgrading trick economically stems from development of a new process in a 25-tons/day pilot plant. It involves reducing rock's calcium carbonate to oxide by calcination, then hydrating oxide and hydraulically or pneumatically separating hydroxide formed.

Rocket technique to make plastic tanks

Borrowing a leaf from rocket technology, a storage-tank maker has decided to turn out plastic storage tanks in much the same way that solid-fuel rocket casings are made. Reason: Tanks of this material and manufacture virtually eliminate need for repair and main-



"EFU" Explosion-Proof Fixtures Give Safe, Bright Illumination in Paint Plants . . .



Dependable, Trouble-Free Service in Hazardous Area Paint Shops . . .



Modern, 45° Angle Mount in Garage Pits . . . or Wherever Safe Lighting is Required

For Hazardous Area Lighting
You Can Rely On...

APPLETON

"EFU" Explosion-Proof Fluorescent Fixtures

Quality built in every detail, APPLETON "EFU" fixtures are prefectly designed and carefully constructed by experienced craftsmen. Factory sealing eliminates the need for external seals. In addition, all models have cast aluminum end housings containing terminal blocks where line connections are made, and aluminum threaded covers to protect line connections, starters and lamps from hazardous fumes, dirt or dust. All lamps are protected and totally enclosed by heavy Pyrex glass tubes.

APPLETON "EFU" fluorescent fixtures are U.L. and C.S.A. approved and meet specifications of Article 500 of the National Electric Code.

Sold Through Franchised Distributors Only

Type "EFU" 2-Lamp Fixture 45° Angle Mounted and Suspended From Type "ESS" Swivel Mounted On "GRFC" Flanged Unilet With Ganopy







 Choice of 33 different models (see chart below)

Available in 2, 3, or 4 lamp styles
 Choice of horizontal or

 Choice of horizontal or 45° mounting

Steel reflectors . . . white enameled inside, grey outside

- Relamping from either end
- "Rapid Start" ballast where desired
- Streamlined design, totally enclosed yet easily accessible
- Application layouts furnished by APPLETON upon receipt of installation data

"EFU" Fixtures Available As Indicated By .



Circuit Voltage 60 Cycle	40	WATT, 48 II	NCH	100 WAT1 T-17-	60 INCH	
	Bi	-Pm	Single- Pin			No. Lamps
	Pro- Heat	Rapid- Start	Instant- Start Stimline	Pre- Heat	Rapid- Start	
			•	•		2
110-125						3
				•		4
	•					2
199-216						4
	•					2
220-250						3
					•	4
250-290	•			•		2
	-	•				3
						4

tenance, yet cost no more than their steel counterparts.

Black, Sivalls & Bryson, Kansas City, Mo., will begin marketing early in 1960 a line of glass-reinforced epoxy-resin storage vessels produced by the filament-winding technique invented by Young Development Div. of Hercules Powder for the manufacture of rocket casings, and now also used in some plastic pipe production. Tank capacities will range from 9,000-20,000 gal., measure 10 and 12 ft. dia, and 15-24 ft. high.

Bad news for high-energy-fuel engineers

Latest decisions by Defense Dept., on status of the three high-energy-fuel plants hit by recent cancellation of quantity borane fuel production (*Chementator*, Sept. 7, 1959, p. 68) snatch away any shreds of hope remaining for the nearly 300 engineers employed at the facilities.

Based on recommendations of Pentagon's Joint Working Group on Special Fuels, seven private advisers and Arthur D. Little, Inc., these decisions mean almost certain immediate unemployment to the vast majority of these engineers, and eventual unemployment to all of them.

- Air Force's \$45-million, 5-ton/day plant at Model City, N. Y., run by Olin Mathieson, will be shut down and dismantled. One small section will be kept on stream for the time being to make research quantities of boron trichloride.
- Air Force's 0.8-ton/day pilot plant at Lewiston, N. Y., also run by OM and to use Model City's boron trichloride output, will continue to produce research quantities of borane fuels only "until a lower cost source becomes available."
- Navy's \$38-million, 5-ton/day plant at Muskogee, Okla., run by Callery Chemical, will be shut down. Unlike Model City however, it will be kept intact and on a "hotstandby" basis until June 1960. Then Pentagon will decide if this status can be justified.

The somewhat more favorable fate of Muskogee stems chiefly from the findings of ADL's study. Study reported that Muskogee produces fuel at less cost than Model City, has greater flexibility for intermittent operation, can be run more economically below rated capacity, is at a greater state of readiness and could be restored to full operation after a standby period at less cost.

While its moves virtually eliminate borane fuels for use in air-breathing engines, Pentagon is still interested in them as possible rocket propellants. For studies on this possibility, it needs about 150,000 lb. of pentaborane and 6,000 lb. of decaborane to be supplied by the Lewiston pilot plant.

Udy process named for steel making

Talk in the last few months about the commercialization of the Strategic-Udy smelting process (*Chementator*, Mar. 23, 1959 p. 90) has finally reached the "naming names" stage.

Process owner Strategic Materials Corp., Buffalo, N. Y., and real estate operator Webb & Knapp, Inc., New York, N. Y., have set up Webb & Knapp Strategic Corp. to produce steel, zinc and copper from waste copper slag via the Udy electric-furnace technique. And CE learns that Quebec South Shore Steel Co. is well advanced with plans to use the process for producing steel and recovering titanium from titaniferous iron ores.

Still cozy about identifying themselves, however, are three "western hemisphere" firms whose studies of the process are expected to be transformed into commercial projects within the next six months.

W&K Strategic plans a \$15-million revamp of an abandoned copper smelting plant at Clarkdale, Ariz., owned by the real estate firm. Plant will be fitted out for Udy-processing of a 30-million-ton copper slag pile at the site assaying 33% iron, 2% zinc and 0.5% copper. Its initial output is to be 500 tons/day steel, later 1,000 tons, plus copper matte and zinc powder.

Too, company intends to build a similar \$20-million smelter at Anaconda's copper mill in Anaconda, Mont., to process the 40-millionton slag pile there that's growing at the rate of 1,000 tons/day. And company is seriously eyeing the slag heaps at Kennecott Copper's Salt Lake City plant and Phelps Dodge's Douglas, Ariz., unit.

Technical feasibility of using the Udy process on copper slag has been demonstrated in Strategic Materials' Niagara Falls, Canada, pilot plant (Chem. Eng., Apr. 1957, p. 166). Koppers Co., which is expected to engineer W&K Strategic's projects, reports that this material can be handled in very much the same fashion as the ferromanganese, chrome,

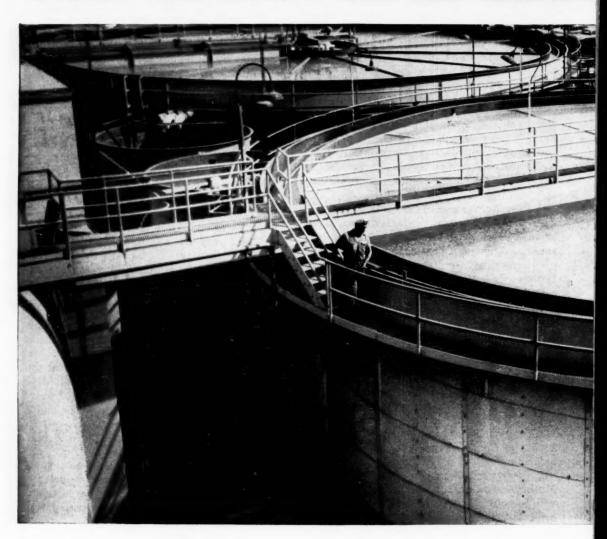
(Continued on page 98)

At Diamond Alkali Company



MODERN BRINE

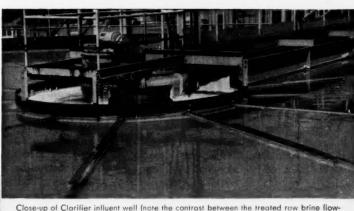
TREATMENT PLANT HANDLES LARGE CAPACITY WITH DORR CLARIFIERS



The recently modernized brine treatment plant of the Diamond Alkali Company, at Painesville, Ohio, is one of the largest of its kind in the world. Its design is the result of a coordinated research project carried out by Diamond Alkali's Research Center and Dorr-Oliver's Testing Laboratories at Westport, Conn.

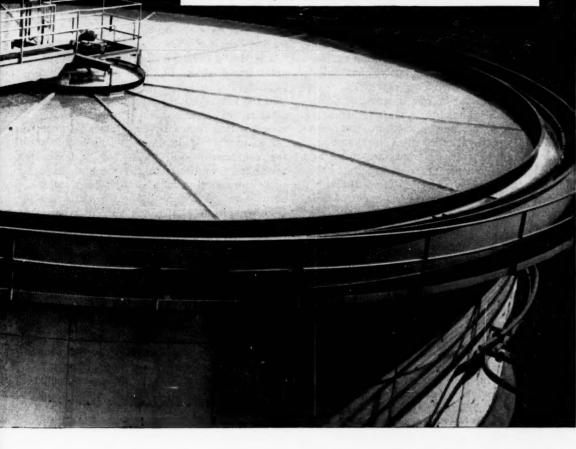
Raw brine from underground wells is stored in a service reservoir, then given pre-treatment with chemicals in Dorr paddle agitators before passing to two 70' diam. Dorr Clarifiers. The thickened underflow is withdrawn by Dorrco Diaphragm Pumps.

This installation is another example of the adaptability of Dorr-Oliver designs to meet highly specialized requirements. There is a type of Dorr Thickener or Clarifier for virtually every sedimentation or clarification problem in chemical, metallurgical and industrial processing. The long experience of Dorr-Oliver engineers is always at your service to suggest the most effective design and to work out any modifications that may be necessary. Write to Dorr-Oliver Incorporated, Stamford, Conn.—or better still, have one of our engineers call and discuss your particular application.



Close-up of Clarifier influent well (note the contrast between the treated raw brine flowing through the feed channel and the clarified product at the surface of the tank.)

LARGE PHOTO shows the two Dorr Clarifiers in operation. Units are equipped with radial beams and a submerged peripheral launder system.





WORLD-WIDE RESEARCH . ENGINEERING . EQUIPMENT

nickel and iron ores that previously have been tried successfully.

Copper slag feeds to an oil-fired reverberatory furnace along with coal, lime and reducing agents. Copper and zinc separate and are tapped for recovery. Iron oxide in slag is partially pre-reduced, then slag is drawn off and fed to the Udy submerged-arc electric furnace. There oxide is processed into semisteel which is refined in conventional steelmaking equipment.

Now polypropylene can be vat dyed

French researchers have come up with what may very well be the most vital ingredient in the growth of that lusty infant, the polypropylene industry. Institut Francais du Petrole reveals that it has discovered a simple inexpensive way of making polyolefins suitable for conventional dyeing processes.

Difficulty of vat or spin dyeing polyolefin yarns and fabrics has been a major stumbling block in polypropylenes entry into the 560-million-lb./yr. synthetic fiber marketplace. Melt dyeing, in which colorants are added to resin before filament extrusion, has been one gallant try to sidestep the difficulty. But this approach takes dyeing out of the hands of the color-conscious textile manufacturer and limits variety of yarn colors to those the extruder chooses.

French discovery permits fibers and fabrics to be vat and spun dyed in the full spectrum of basic and acid colors. Now seeking patents, IFP says only that the process consists of dipping polyolefin materials into a chemical reagent for one minute, then rinsing off excess in water. Unidentified chemical is used in concentrations of 10-20% and costs less than 30¢/lb.

Montecatini also reports success in preparing polypropylene for conventional dyeing practices. At Milan Fair earlier this year, company's Guilio Natta indicated that the key lay in chemically grafting dyeable groups on polymer chain. Company now is showing brightly hued polypropylene fabrics, both pure and in blends, that can be made from staple and yarn to be produced at its 10-millionlb./yr. plant due on stream this month.

IFP has put its technique up for licensing, reports that it has interested a Japanese firm. U.S. companies who've recently flocked into the polypropylene business—including Firestone, Dow, AviSun, Texas Eastman—are ex-

pected to give the technique serious study since they are counting heavily on the synthetic fibers market for their products.

New process eyes market forecasts

First Hydeal plant is on the drawing boards destined for service at an unidentified petroleum refinery to convert toluene and xylenes into benzene.

This news—as did the announcement of development of this catalytic hydrodealkylation process (Chementator, Oct. 5, 1959, p. 35)—seems to fly straight into the face of the fact that a benzene over-capacity exists right now. But a closer look turns it into a prime example of how closely technology is tied to market behavior.

Hydeal's developers, Universal Oil Products, Des Plaines, Ill., and Ashland Oil & Refining, Ashland, Ky., have looked ten years into the future for their chief reason for developing this benzene-making process. Longrange market forecasts indicate that demand for toluene and xylenes—especially as motor fuel ingredients—will plateau while demand for benzene continues to rise steeply. Since these products usually are made simultaneously, refiners trying to meet benzene market needs could have toluene and xylenes coming out of their ears.

Thus, UOP reports first commercial tasks for Hydeal will be in dealkylating reformate streams, light oils and other mixed aromatics found at refineries. But it's also touting the process for upgrading purity of coal-tar benzene, producing phenol and naphthalene from cresols and alkylnaphthalenes.

In benzene manufacture, feed is mixed with hydrogen-containing gas (as offgas from reforming unit), preheated and charged to dealkylation reactor. There it's contacted with a solid catalyst, passed to a cooler and separator. Separator offgas is recycled to reactor with hydrogen makeup. Liquid effluent is stabilized, then distilled to secure nitration-grade benzene. Still bottoms are recycled to reactor. UOP claims yields of benzene from toluene around 90-95%, from xylenes 85-90% of theoretical.

Rush into maleic-fumaric mounting

Despite sharp price cuts posted by Monsanto last month—18% on maleic anhydride and 15% on fumaric acid—mounting enthu-

When it comes to

MINERAL ACIDS

SULFURIC ACID

Standard: 60° and 66° Baumé, 99% H₂SO₄ Diamond: 66° Baumé Reagent, ACS

NITRIC ACID

Diamond: 36°, 38°, 40°, and 42° Baumé Strong Nitric Acid, 95% and fuming grades Photo-Engravers' Grade Reagent, ACS

MURIATIC (Hydrochloric) ACID

18°, 20° and 22° Baumé, Standard, Diamond, Crystal and Reagent Grades

HYDROFLUORIC ACID

Anhydrous, Aqueous 70%, and Reagent

PHOSPHORIC ACID

Wet Process, 65% and 75%, Com'l and Fertilizer Grades Food Grade, 75% N.F., 85%

MIXED ACID

Varying proportions of Nitric and Sulfuric Acids to meet customers' requirements

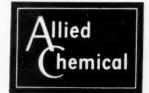


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For 60 years, General Chemical has been the nation's primary producer of heavy acids. General has its own basic raw material sources. Its production facilities include 21* sulfuric plants, 4* hydrofluoric plants, 3 nitric and 3 muriatic acid plants. It operates one of the nation's largest fleets of tank cars, tank trucks and acid-carrying barges, and distributes from key points coast-to-coast. General's production, transportation, service and sales facilities are geared to meet your requirements best, both in quality of product and dependability of service. Write or phone today for information or service.

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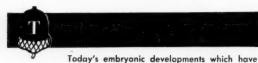
siasm for the maleic-fumaric business shows no sign of abating. Producers continue tumbling over each other to get into the field.

Latest to join the throng: Utah Resin Co. It's bringing on stream this month a 2.4-million lb./yr. fumaric acid plant in Salt Lake City. Company intends output for captive use in isophthalic polyester resin production.

URC's move is underscored by three others. Pittsburgh Coke & Chemical plans to announce contractor for its 15-million-lb./yr. fumaric plant, a project that has been under the cloud of cancellation recently. Heyden-Newport declares that it will go ahead with its 24-million-lb./yr. maleic-fumaric facility which also wasn't a dead certainty. And a leading engineer-contractor of maleic plants tells CE that it has several installations under contract that have yet to be announced.

These developments follow hard on the heels of a rush of new capacity announcements that started this year. They came from National Aniline, American Cyanamid, Reichhold, Oronite and Monsanto.

Booming polyester resin, alkyd resin and agricultural chemical markets account for maleic anhydride's popularity; growing trend to use fumaric acid in the new isophthalic polyester resins explains fumaric activity.



special significance for chemical engineers

Gasoline brick: A solid emulsion

Russians have revealed how they make those "gasoline bricks" that they carried on their International Geophysical Year expedition to Antarctica. Developed at the Institute of Fuels of the U.S.S.R. Academy of Sciences, the process produces a bright-yellow, highly concentrated solid emulsion consisting of 95% gasoline trapped in honeycomb-like cells.

Emulsion-forming material is a distilled water solution of ammonium chloride, casein, polyvinyl alcohol and glycerine. Gasoline is added to this solution. Combined action of mechanical and ultrasonic-wave agitation for 5-6 min, forms the emulsion.

A 20% formaldehyde solution and oxalic acid are then introduced with further vigorous mixing to increase emulsion's viscosity. When material thickens to the point of being a solid,

it's pressed into long strands, cut to the desired briquet shapes and dried.

Bricks can be transformed back into liquid with a specially designed machine that breaks up the solid and squeezes liquid gasoline from the honeycomb cells of emulsion. Gasoline losses are less than 3%, Russians report.

Value of making this material apparently is that it permits shipment of gasoline as a solid and use as a liquid. U.S. industry observers speculate that need for the combination means Soviets don't have country-wide use for tank cars. Tank cars carrying liquids such as gasoline to far reaches of the Soviet Union probably don't often find liquid shipments for the return trip, must deadhead home. Box cars, carrying gasoline bricks, however, could easily find solids to pay for their return journeys.

Research and development briefs

Mixed gases yield tungsten in a new highpurity process developed by the Bureau of Mines. Mixture of tungsten hexafluoride and hydrogen is pumped through copper tube at 1,100 F. where 99.99%-pure tungsten deposits on tube walls. Metal builds up into an "innertube" of desired thickness, then copper is stripped off leaving tungsten formed in a useful shape.

Polyurethane's temperature tolerance has led to testing of polyurethane film as a substrate on magnetic tapes exposed to extreme temperatures. Experimental lots produced by DuPont have outperformed company's widely used polyester Mylar film at temperatures below —60 C to over 200 C. Need for such film stems from growing use of magnetictape recorder guidance systems on rockets, satellites and other outer-space vehicles.

Nitrous oxide looks feasible as a tracer in hydrostatic leak testing reports Dr. William E. Thompson, Southwest Research Institute, San Antonio, Tex. Injected into buried pipelines with water, the gas will trigger response on an infrared analyzer in amounts as low as 0.007 lb./hr. SRI believes method will be quicker and less expensive than standard hydrostatic testing now costing upwards of \$1,000/day, could be used on containers, too.

For more on DEVELOPMENTS......102

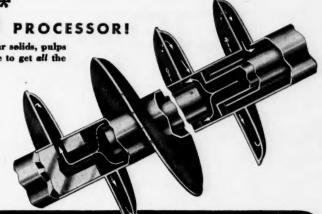
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HOLO-FLITE handles such processes — in continuous flow — in as little as 1/5th the space of other types of heat exchangers. What's more, it is readily adaptable to a wide range of applications — is simple to install and maintain — and provides many other important savings.



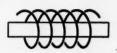
typical HOLO-FLITE advantages...



ITS APPLICATION FLEXIBILITY is almost unlimited. It cools, heats, or dries. It handles granular solids, pulps, pastes, slurries and fluids with equal ease. Its heat transfer agent can be water, refrigerant, het oil, Dowtherm, steam or other liquids or vapors at any of a wide range of temperatures. It cools materials in ranges from 1800°F to 0°F. It heats and dries with het eil to 600°F... with Dowtherm to 750°F... with steam to 150 lbs. per sq. in. pressure.



THE LARGE HEAT-TRANSFER SURFACE saves space — HOLO-FLITE requires as little as 1/5th the space of other heat-exchange equipment of comparable capacity. Moreover, a more complete heat transfer is effected, resulting in more uniform processing.



RQTATION 15 SLOW — granular and powdered solids are handled with practically no dusting — negligible abrasion. There are no dust recovery problems — a further saving in installation, maintenance and operating costs!





its OPERATING CAPACITY is readily adaptable to virtually any requirements by simply varying the diameter, pitch, and length of flights, as well as the number of "tiers." Multi-tier hits require no more floor space man single-tier installations!

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Basically the HOLO-FLITE consists of one or more flights of hollow-bladed screw conveyors. The product to be processed moves through a trough housing the conveyor screws. The heat-transfer fluid circulates through the hollow blades and shafts of the conveyor. The product is constantly rotated into, around, under and over the blades and shafts through which the heat-transfer fluid is circulating, assuring quick, uniform heat passage between the two mediums — as the product is continuously moved along in a bulk-flow without interruptions!

There are many money and time-saving applications for the Holo-Flite wherever products are cooled, dried, heated or even calcined. Let our engineers study your particular problem and make helpful recommendations. No obligation, of course!

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HI-TURBIANT Heaters



On-Line Computer Scores High in

First of its kind, Texaco's digital computer completes six months in process control loop, proves out reliability.

At its Port Arthur, Tex., refinery, Texaco, Inc., has completed six months operating its No. 1 cat poly unit under control of a digital computer. Throughout the industry, process control men have been keeping close tabs on the installation, first of its kind in the U. S. A.

So far, they've had little direct news from Texaco about the computer's performance. But there's a feeling in the air, fed by countless chitchat from

co's computer has performed

▶ Prove Reliability-What this may portend for computer con-

smoke-filled rooms, that Texa-

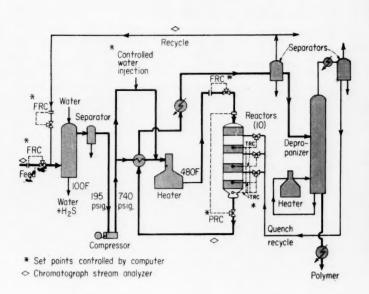
trol of processes was high-lighted by computerman Bill Aiken some time prior to Texaco's startup, "Reliability of the process-control computer must surpass that of the business or scientific machine by a substantial factor; it will not be possible to make up lost working time by extending a 24-hr. operation into overtime."

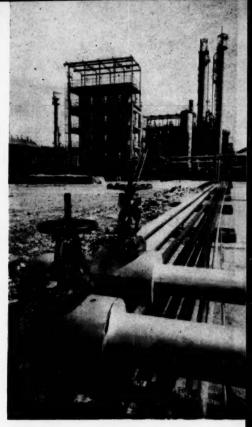
With the science of computer application advancing at a rapid rate, neither Bill Aiken nor any of his colleagues have doubted their ability to tie computers into process control loops. But they have been forced to convince others of the reliability of digital computers such as the RW-300 at Port Arthur, developed by Aiken's concern, Thompson-Ramo-Wooldridge Products Co. Next: The Payout-Now that Texaco's prolonged run has cut through a few of the doubts about computer reliability, some of the economic promise of computer control shines clearer.

Although Texaco has been reticent about payout - rightfully pointing out the experimental aspects of the application-it's not hard to see that the company expects an early

return.

Texaco's cat poly unit, a standard UOP solid phosphoric acid catalytic process used in





Big Test: Control of Refinery Unit

well over 100 refineries, upgrades feed containing 30% propylene, as well as ethylene and lower straight-chain parafins. Product stream discharging from unit is rich in tripropylene polymers.

Value of propylene in the feed runs about \$1.10/bbl. Since 14 bbl. of propylene makes 1 bbl. of polymer which is worth about \$5/bbl., cat poly unit actually adds value equivalent to \$3.60/bbl.

With unit turning out 1,800 bbl./day of product for 340 days/yr., computer control will pay out easily within two years, if successful. That's based on equipment and engineering cost quoted at around \$300,000 and improvement of yield from 85 to 93%. Longer expected catalyst life will add a \$75,000/yr. safety factor to payout.

These estimates will be put

to the test by an off-line digital accounting computer working on data collected by the RW-300. Over an extended period of time, it will be possible—if necessary, by use of statistics—to show what benefits have accrued.

► Source of Data — Texaco's RW-300 computer receives input signals from instruments sensing 26 flowrates, 72 temperatures, three gas analyses, three pressures, and calibration, clock and check signals.

Using these signals, computer calculates and sends output signals to the three-mode pneumatic controllers. Acting through these instruments, computer controls flowrates to each of 10 reactors; one system pressure; flowrates of feed, recycle and catalyst hydration water; and reactor outlet temperatures for each group of five reactors.

► Computer Balances Factors— In calculating the values of the output signals, computer strives to optimize operation, balancing long catalyst life against high polymer yield. Factors affecting this balance include system pressure, temperature in the reaction zones, water of catalyst hydration, propylene concentration and feed rate.

Pressure favors olefin conversion and also helps keep catalyst clean. During conversion small amounts of higher-weight tarlike polymers form which tend to plug catalyst voids. Operating at elevated pressures, the gas is sufficiently dense to "wash" these poison tars off the catalyst.

Low temperature, on the other hand, favors catalyst activity. Exothermic reaction—670 Btu./lb. of propylene polymerized—forces plant to con-

trol temperature in order to favor high conversion yet not affect catalyst activity adversely by forming higher polymers.

Water content of the charge stock must be controlled carefully to a fraction of 1%. Too much water will soften and plug catalyst beds and carry over H₂PO₄ to corrode downstream equipment; too little will lead to coke formation and reduction of activity.

Propylene concentration is regulated by light hydrocarbon recycle and by individual quench at each bed. These dilutions limit temperature rise in the beds to a desirable level.

Flowrate affects conversion by varying contact time. At low catalyst activity, for example, contact time should be greater and thus linear velocity through the beds slower than at high catalyst activity.

▶ Build Math Model—To set up control of the process so that the computer could optimize these variables, engineers from TRWP and Texaco came up with an expression relating the variables to conversion.

It's likely that the equation uses semi-empirical relation known as the severity factor to give a measure of over-all reaction condition that exists under the influence of several variables. Popular with kineticists examining complex processes, this approach correlates conversion with dimensionless functions of the operating variables.

For use with this expression, these engineers also derived a profit-rate equation which combines product value, feed cost, operating and fixed costs and the appropriate flowrates.

Finally, since it's impossible rigorously to relate catalyst life to operating variables, the engineers imposed on the variables a set of arbitrary boundaries known to give satisfactory catalyst life. These include, for example, temperature constraints:

470 F. $\leq T \leq$ 490 F. and pressure constraints: 700 psig. $\leq P \leq$ 740 psig.

In addition the sum of feeds to the reactors must not exceed total feed available. Framework for Analysis—Chemical engineering theory formed the framework for the analysis. Since plant has been on stream for over 15 yr., the engineers were able to evaluate statistically data obtained from laboratory, pilot plant and large scale operations during this period in order to get constants. With such a wealth of ready information, Texaco did not need to undertake data logging preliminary to the analysis.

Dimensionless functions were described for the computer program by equations. Other equations also were written into the program along with such auxiliary functions as alarm limits and "reasonableness" checks on inputs to the computer from controllers, periodic self-checks by computer, demand and periodic logging of variables.

► Sell the Program—To bolster their own confidence and help show Texaco the virtue of the model-building approach, the project engineers used their model for a three-fold test.

By plant test, they proved that they could accurately predict the effects of deliberate controller set-point changes. Then they took a recent operating period covering several weeks and calculated production that would have been observed under computer control, compared it with actual production.

Finally, they compared online optimization with once-aweek off-line optimization which is a common refinery processimprovement procedure.

Pleased with the results, Texaco gave go-ahead signal for project. Final decisions on process control scheme were settled by choice of the process model.

► Still Unanswered — Although the Texaco-TRWP project has scored some points — smooth startup, a successfully built model and appropriate reliability—there are some questions that might well be asked.

First, after the detailed process study which produced a 318-p. report, could engineering team possibly have improved process notably without computer control? How much economic improvement would

show by addition of a new instrumentation system alone (carried out during modernization for computer control) or by changing the size of catalyst beds?

Second, if the process-analysis, model-building approach works, will TWRP run into same difficulty that has plagued instrument makers generally: How do you handle fees for extensive engineering services that precede equipment bids?

And, finally, was the process and economic evaluation realistic?

As answers to these questions unfold at Port Arthur, they will guide Texaco in its contemplation of computer studies on other processes in its refineries, will bolster TWRP experience for more effective joint studies with other chemical and petroleum firms.

New Plant, New Process For Insecticide Chemical

Stauffer Chemical Co. is now building a new \$500,000 plant at Henderson, Nev., to produce —by a "radically" new process —parachloro thiophenol, primary intermediate for Stauffer's organic phosphate insecticide, trithion.

Though the company won't disclose process details, it most likely uses a variation of the classical route: chlorosulfonation of chlorobenzene to chlorobenzene sulfonyl chloride, followed by reduction to the thiol.

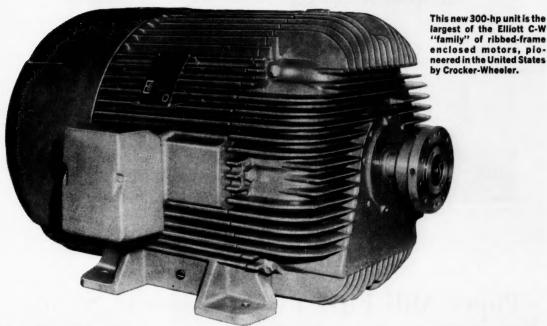
Stauffer says it will continue making the intermediate at its Niagara Falls, N. Y., plant until Henderson is on stream.

Detailed manufacturing techniques to produce trithion are also under wraps, but Stauffer does point out key steps in patents that bear on its process.

Essentially, trithion synthesis goes like this:

Intermediate p-chlorothiophenol, reacts with formaldehyde and anhydrous hydrochloric acid to yield p-chloro phenylchloro methyl sulfide. This, in turn, is reacted with sodium diethyl dithiophosphate to produce trithion.

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Extra fins keep bearing cool. This potential trouble spot is effectively cooled by the generous extra fins seen in the photograph above.

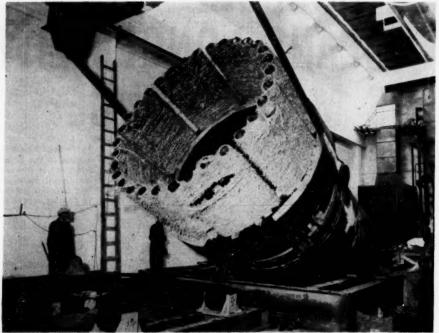


Cooling blast hugs frame. Air is directed along fins extending entire motor length. Easy to clean - no enclosed cooling passages to clog up.



Newest data on modern enclosed motors-including explosion-proof-is given in Elliott Bulletin PB 6000-2. Send for free copy today.

W9-2



NUCLEAR reactor vessel goes into place adjacent to Norwegian paper mill.

Paper Mill First to Use Nuclear Steam

Norwegian paper mill and nuclear plant strive, hand-in-hand, to prove out heavy water reactor fueled by natural uranium.

First nuclear reactor to generate steam for process use will be a 10,000-kw heavy-water-moderated unit now operating adjacent to the Saugbrugsforeingen pulp and paper mill, Halden, Norway.

Strictly speaking, the Halden Boiling Heavy Water Reactor (HBHWR) is an experimental effort rather than the triumphal fruition of reactor technology for process use. Its purpose: To develop technology and operating experience for heavy watermoderated reactors fueled with natural uranium. ► Experiment, Then Produce— In pursuit of this aim, Halden now is operating with an experimental core of aluminum-clad, natural uranium fuel elements, spiked with stainless-steel-clad UO₂ clusters.

On completing the experimental program, Halden will swing over to production of 325-psi. process steam for the Saugbrugsforeingen mill in an effort to write off the cost of the project. For this phase of the operation, reactor will use a core of stainless-steel-clad, enriched-UO, fuel elements. Even-

tually, reactor operating level will be doubled.

▶ Wide Interest—Sponsor of the \$3.7-million Halden project is the Norway-Netherlands Joint Establishment for Nuclear Energy Research (JENER), with experts from Argonne National Laboratory, Lemont, Ill., acting as consultants. But keen interest in the program extends beyond JENER throughout Europe, fostered by the hope that heavy water holds the key to eventual use of natural uranium as a reactor fuel.

As a moderator for fissioning



CONDENSER AND HEAT EXCHANGER CLINIC

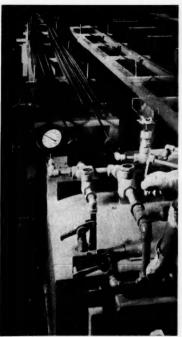
Edited by David S, Hibbard, Metallurgical Engineer The American Brass Company, Buffalo 5, New York

New controls and services meet increasingly critical requirements in heat-transfer units

As steam cycles in turbines become more complex—and operating temperatures and pressures rise—the job of the heat-transfer equipment becomes increasingly critical. Nuclear energy plants place tremendous emphasis on continuity of service for even conventional components like condensers. And in many processing plants the cost of shutdowns may range from exorbitant to disastrous.

Assurance that tubes will meet service requirements becomes increasingly important. And The American Brass Company has augmented its normal quality controls with tests and services to help makers of heat transfer equipment prevent possible trouble before it starts.

Electronic inspection. All tubes are inspected visually one at a time, both internally and externally. However,



All U-bend tubes are tested hydrostatically at ASME Code pressures—or higher, if necessary.



All tubes are inspected visually one at a time, both externally and internally.

When required, tubes are inspected by eddycurrent equipment, located at the tube straightener.

where greater assurance is required, the tubes—in straight lengths up to 100′—can be inspected electronically by eddycurrent equipment.

Hydrostatic testing. As most U-bend tubes are used in applications involving high temperatures and pressures, all of these tubes are tested hydrostatically—after bending—at ASTM Specification pressures. They can, however, be tested at ASME Code pressures, up to 6000 psi, on request, if the tube size is such that it will withstand the pressure.

Relieving stresses. All U-bend tubes, other than copper, are annealed at the bend area after bending, to eliminate the hazard of stress-corrosion cracking which might occur in service due to stresses that may exist as a result of the bending.

Duplex tubes are widely used in chemical plants and petroleum refineries to meet diverse combinations of corrosive action and/or pressure and temperature. Recently designers have selected them for use in air-removal sections of electric-power-plant condensers where corrosion is very severe.

Broadest service. In helping manufacturers and users of heat-transfer equipment meet day-to-day problems, The American Brass Company has a broad background in the latest developments in heat-transfer equipment's expanding role. And with new mill equipment now in place, it offers the broadest service available in tubes for heat-transfer equipment. For technical assistance in special problems, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

TUBES AND PLATES FOR
CONDENSERS and HEAT EXCHANGERS

Made by

THE AMERICAN BRASS COMPANY



NESTLED in hillside, reactor (just left of stack), produces steam for mill.

uranium, heavy water absorbs little of the neutron flux. Thus, it's ideal in reactors running on natural or low-enrichment fuel where neutron economy is crucial. Unable to produce enriched uranium, European countries see their nuclear power future tied to successful development of heavy-water-moderated reactors which will operate on readily available natural uranium or low-enrichment fuel.

But JENER research efforts to develop know-how for heavy water reactors are far from singular. Countries in both old and new worlds are expending millions of dollars and research manhours to gain a position in the expanding technology of heavy water.

► U.S. Activity — Here in the U.S.A., several research projects are under way to develop heavy water reactor technology and economic information. At the same time, at least four major heavy water power reactors are on the drawing boards.

Recent studies completed for the USAEC by Nuclear Development Corp. of America (NDA), White Plains, N. Y., under subcontract to Sargent & Lundy Engineers, have brought to light the strong and weak points of heavy water reactors.

Their main advantage, of course, is the high neutron economy mentioned previously. Another strong point is the inherent long life of the reactor fuel

Points of question are: Is the greater capital cost warranted; what will be the losses of costly heavy water in actual operation? The AEC now estimates that a loss of 17 gal./day of

heavy water would add 1 mill/ kwh. to the power costs of a 200,000-ekw. power plant.

► Seek Answers — Efforts by NDA at its Pawling, N. Y., research facility aim at answering the technological questions about heavy water. For that purpose, NDA operates a thermal, heavy-water-moderated and reflected reactor, the Pawling Research Reactor (PRR).

Answers to the operational questions can only be found when reactors now in the planning stage actually go critical (see tabulation).

► Close Cooperation — In another direction, the U.S.A. is cooperating closely with Canada, another leader in development of heavy water reactors. Canada has turned to heavy water because of its huge reserves of uranium ore.

Test reactors operated by Atomic Energy of Canada, Ltd. (AECL), to develop fundamental heavy water knowhow are the ZEEP, PTR and NRX.

Canadian General Electric, Ltd. (CGE), now is undertaking preliminary design for Canada's first heavy water power reactor, the Nuclear Power Demonstration NPD-2. Fueled with natural uranium, reactor is cooled with pressurized heavy water and moderated with heavy water at atmospheric pressure.

Another CGE development is the Organic-Cooled Terphenyl Heavy Water Moderated Reactor design. CGE has shown that by moderating a nuclear reactor with heavy water, thermal and radiolytic decomposition of the terphenyl coolant is decreased greatly.

► Other Developments Abroad—Activities in this sphere are gaining momentum in other areas around the globe.

In India last summer, the Government of India signed a contract to lease 15 tons of heavy water for a zero-energy research reactor to be installed in Trombay.

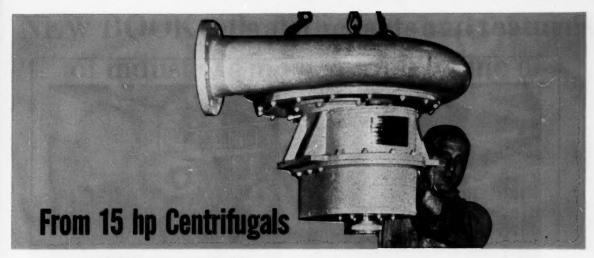
Last spring in Ispra, Italy, a 5,000-kw. tank-type heavy water reactor was dedicated. With this \$4-million research installation, Italy plans to learn more about operating heavy water reactors.

Spain's Junta de Energia Nu-

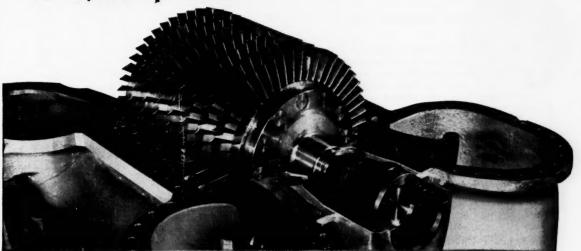
Heavy-Water Power Reactors Planned for U.S.A.

Moderator	Coolant	Type	Fuel	Power	Date
Heavy water	Heavy water	Pressure tube	Natural UO2 and plutonium- aluminum alloy	70,000 tkw.	Fall 1960
Heavy water	Heavy water	Pressure vessel	Natural U and enriched UO ₂	60,000 tkw.	Spring 1962
Heavy water	Heavy water	Pressure tube	Enriched UO ₂	60,000 tkw.	Summer 1962
Heavy water	Gas- cooled		Enriched UO ₂	229,000 tkw.	June 1963
	Heavy water Heavy water Heavy water Heavy	Heavy water Heavy water Heavy water Heavy water Heavy water Heavy Gas-	Heavy water Water Pressure tube Heavy water Pressure vessel Heavy water Water Pressure vessel Heavy water Water Ube Heavy Gas	Heavy water	Heavy water bube UO2 and plutonium-aluminum alloy Heavy water water vessel U and enriched UO2 Heavy water water tube UO2 Heavy water vessel U and enriched UO2 Heavy water tube UO2 Heavy water Enriched 229,000 tkw.

^{*} Prototypes for larger scale natural-uranium-fueled reactors.



to 15,000 hp Axials . . .



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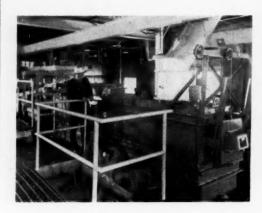


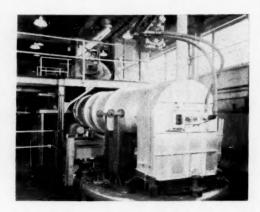


JOY

Joy Manufacturing Company Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario





Traveling Grate Preheats Feed for Pilot Kiln

Efficiency and cleanliness in pelleting, heat treating and handling of various raw materials are goals of Allis-Chalmers' new pilot plant, recently started up at Carrollville, Wis. Plant handles minerals and concentrates from many sources in samples of several tons.

Heart of the unit is a traveling-grate and kiln arrangement which helps remove dust and preheat

pellets. (For use of such a system in a commercial cement plant, see *Chem. Eng.*, Apr. 21, 1958, p. 60.) Traveling-grate section (left photo) is divided into drying and preheating zones with respective windboxes. Discharging kiln gas from rotary kiln (right photo) dries and preheats pellets. Sensible heat of kiln products is recovered in annular cooler, lower part of photo.

clear has contracted with Atomics International to study the feasibility of operating a 20,000-ekw. heavy-water-moderated, organic-cooled reactor to generate radioisotopes and gain heavy water reactor knowhow. Reactor concept is similar to CGE's.

New Electrolytic Route Makes Ductile Titanium

Starting point for a new process to make ductile titanium metal is an electrolytic cell which uses relatively inexpensive titanium carbide as its anode.

Crowning seven years of effort on the part of Norton Co. research men, Guy Ervin, Jr., Herbert Ueltz and Malcolm Washburn, new cell produces fine dendritic titanium crystals of purity in the order of 99.6%. Experimental cell, operating at 900 C. under an argon atmosphere, has made 12-lb. batches of titanium.

During electrolysis, titanium separates from its carbide and adheres to the cathode as dendrites of pure metal. After washing to remove electrolyte, these can be melted into ingots or fabricated by powder metallurgy. ▶ Pilot Cell—The cell used in experiments consists of a graphite crucible lined with titanium carbide rings which form the anode. A metal cathode is suspended in the crucible concentric with the anode and can be retracted into a gastight, argon-filled chamber above the cell. Chamber serves as a cooling chamber as well as on air lock through which a batch is removed. Fresh cathode bars can be inserted for semicontinuous operation until titanium has been depleted.

Cell uses direct current at 4 volts and 800-1,000 amperes.

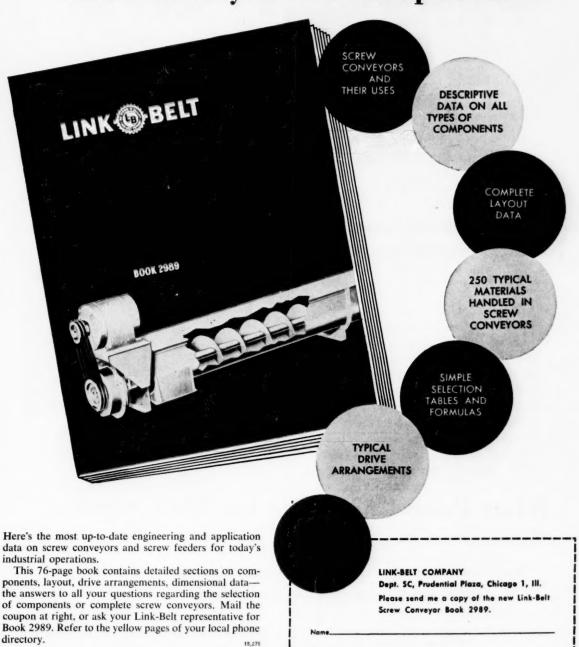
Each pound of titanium produced requires 8-10 kwh.

Though lab cells used in the development were not large enough to fix costs for actual production equipment, inventors are confident that titanium metal could be produced economically. One reason is that titanium carbide contains about titanium—about three times as much as titanium tetrachloride now used in commercial processes.

News Briefs

Polypropylene: Dow Chemical will build a polypropylene plant at Torrance, Calif., scheduled to go on stream in 1961. Facilities, first of their kind for the western U.S., will cost several million and are designed to meet West Coast market requirements "in the foreseeable future."

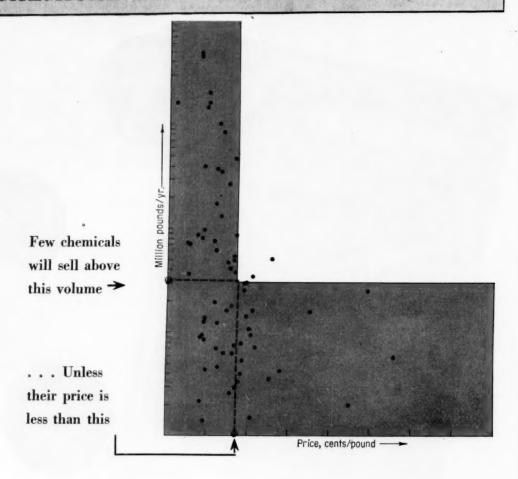
NEW BOOK tells all the facts and features of industry's most complete line of screw conveyors and components



SCREW CONVEYORS . SCREW FEEDERS

DEVELOPMENTS ..

CHEMICAL ECONOMICS EDITED BY D. R. CANNON



What Price Can I Get for My Chemical?

Exclusion-chart method uses historical production-price data to give you a fast answer to this vital question.

Herman W. Zabel and Michael Marchitto, Roger Williams Technical & Economic Services, Inc., Princeton, N. J.

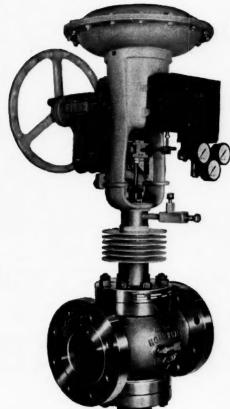
A major question facing all chemical manufacturers is: "What price can I get for my product?" To get a fast, empirical answer, our company has developed, and found increasing use for, a series of plots or

charts which we have dubbed "The Exclusion Charts."*

*Our last publication describing this concept appeared in Chem. Eng. Progr., May 1956, pp. 183-186, and reported data for years up to and including 1954. This article is to show the effects of recent years right through 1958.

Now these plots do not supply the full answer to the question posed above. The best answer can be obtained only after detailed and costly studies of the potential markets and sales prices which may be achieved. is your

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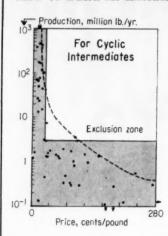
MINNEAPOLIS-HONEYWELL, Fort Washington, Pa.

Honeywell



First in Control

How to Build an Exclusion Chart



The exclusion chart is a plot of the historical relationship between sales price and production volume of chemicals.

Finding enough data to support such an empirical relationship is a problem. However, the production-price data provided in the U.S. Tariff Commission's annual reports on production and sale of synthetic organic chemicals—divided into several enduse categories—give the proof.

Let's, for example, consider cyclic intermediates, one of the Tariff Commission's chemical end-use groups. The particular exclusion chart presented here is derived from Tariff Commission price-production data for 1957.* Each point on the chart represents production and price data for a single chemical in the cyclic intermediates family.

Each arrow off to the right and top of the chart represents a chemical whose production volume or price puts it beyond the range of the graph.

There are many ways the limits for such a chart can be shown. Perhaps the one most often tried is the use of a curve fitted to the upper points of the chart. This has been ruled in for this chart as a dotted line.

Such a curve undoubtedly gives the most accurate representation of the limits. But it is difficult to use. Consequently we have found the use of a single point to be as nearly descriptive of the data as a curve. The coordinates of the single point—a value for production and a value for price—have been ruled in as solid lines.

We have given the name "Exclusion Area" to the space above and to the right of these lines, since the points not found in this area are excluded from this space. Hence the name for these charts: The Exclusion Charts.

This chart pictured at the left shows that, with two exceptions, no cyclic intermediate had a production of more than 3 million lb. in 1957 unless the price was 28¢/lb. or below. The two exceptions—which appear in the exclusion area—are toluene disocyanate and its precursor, 4-m-tolylene diamine.

Nearly 10 million lb. of the disocyanate and 3 million lb. of the diamine were produced, each selling for about \$1/lb.

The exclusion charts do show, however, that in the past no product has sold above a certain volume until its sales price has reached a certain point. And these values vary from end-use to end-use.

Thus, the results provided by these plots furnish only a statement of limits as indicated in past years. We do not say that a product cannot sell at a volume and price higher than the historical limits. High price and high volume can occur, but only if the chemical has very unusual—and economically desirable—properties.

► It's Got to Be Good—Proof of this latter comment rests only upon the fact that nearly all chemicals that have appeared in the "exclusion area"—above the limits of price and volume—have such unusual properties. Take, for example, toluene disocyanate which shows up in the exclusion area for cyclic intermediates (see chart in box, this page). This product's facility for forming polyurethane foams is a truly unusual property.

The exclusion charts' most obvious application is in new-product pricing. However, the technique may also be used when considering price changes on existing products. In this use, the charts serve to indicate the sales volume that can be expected at lower or higher price ranges.

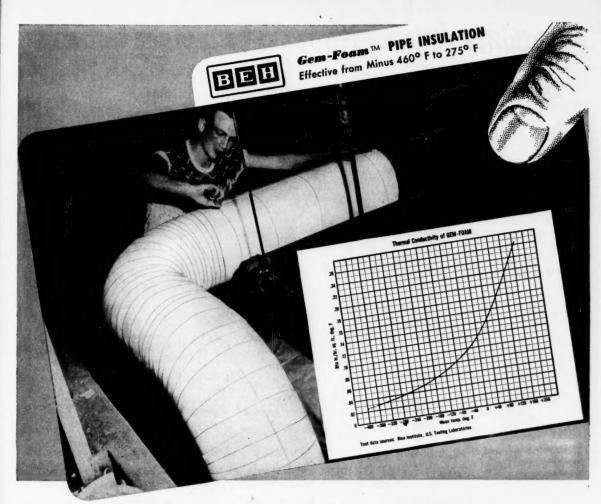
► Cyclic Intermediates — Further understanding of the structure and use of the exclusion chart can best be gained by examination of the charts themselves (see box this page). The chart in this example is plotted from 1957 data. Exclusion charts on cyclic intermediates for 1958, and for several years preceding, show price-volume relationships ranging from 1.9 million lb. and 23¢/lb. in 1947, to 3.7 million lb. and 28¢/lb. last year.

Judging from the data collected for these years and others, we would say any market estimate above 3-4 million lb./yr. for a cyclic intermediate at a sales price of more than $25-30\epsilon/lb$, would appear to be suspect (see table, p. 116).

▶ Medicinal Products—Turning to medicinal products—for which year-to-year data are presented also in the table on p. 116—we find that the limit for 1958 was for an annual production rate of 400,000 lb. at a unit price of \$3.60/lb. The five points within the exclusion area represent production-price relationships for one antibiotic, three vitamins, and å tranquilizer.

These materials have, as do most medicinal products, unusual properties which enable them to command extremely high prices. It is interesting to note that the ascorbic acid volume-price relationship has changed from 1.8 million lb. at \$8.10/lb. in 1954 to over 2.8 million lb. at \$4.10/lb. in 1958.

The authors report that a plot of preliminary data for 1958 results in an exclusion area very similar to that for 1957.



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Chemical Volume-Price Ratios: Here Are Your Working Estimates

	Cyclic Interm	nediates	Medicina	ls	Flavors & Perfumes							
	Annual Production	Price	Annual Production	Price	Annual Production	Price						
	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.						
1947	1,900	0.23	175	3.00	200	3.00						
1949	2,500	0.25	110	4.50	110	2.70						
1952	2,500	0.26	400	4.00	400	1.70						
1954	4,000	0.21	500	3.60	500	1.00						
1955	3,000	0.28	500	3.00	450	1.40						
1956	3,500	0.28	500	3.40	400	1.20						
1957	3,000	0.28	300	3.60	450	1.10						
1958	3,700	0.28	400	2.50	400	1.10						
Working estimate	3-4,000	0.25-0.30	400	2.50	500	1.00-1.20						

	Plastics & R	esins	Plastici	zers	Surface-Activ	e Agents
	Annual Production	Price	Annual Production	Price	Annual Production	Price
	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.
1947		0.52		0.42	2,700	0.20
1949		0.40		0.58	1,000	0.28
1952	2,000	0.45		0.55	1,600	0.41
1954	3,000	0.48		0.46	1,300	0.40
1955	4,100	0.45	2,500	0.32	2,300	0.36
1956	4,000	0.48	2,500	0.32	3,000	0.30
1957	6,000	0.50	2,500	0.32	3,000	0.33
1958	3,000	0.46	2,700	0.31	3,000	0.39
Working estimate	5-10,000	0.50	2,500	0.30-0.35	3,000	0.39

	Pesticide	\$	Rubber-Processi	ng Chemicals	Miscellaneous Chemicals								
	Annual Production	Price	Annual Production	Price	Annual Production	Price							
	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.	Thousand Pounds	\$/Lb.							
1947			6,300	0.42	6,800	0.16							
1949			4,500	0.58	9,000	0.14							
1952	960	0.50	3,200	0.55	5,800	0.19							
1954	4,000	0.58	4,000	0.58	4,500	0.35							
1955	4,000	0.46	5,000	0.56	7,500	0.32							
1956	6,500	0.48	4,000	0.58	8,000	0.25							
1957	6,500	0.44	5,000	0.60	7,000	0.26							
1958	5,500	0.49	2,500	0.50	7,000	0.30							
Working estimate	6,000	0.50	4-6,000	0.50-0.60	10,000	0.30							

Apparently, even those chosen products in the exclusion area obey the same economic laws as do other products "outside."

The increase in sales volume for medicinals, from 175,000 lb. in 1947 to 400,000 lb. in 1958, is almost wholly due to the introduction and increased sales of high-unit-value antibiotics, vitamins and, recently, tranquilizers.

A good limit to use for medicinals appears to be about 400,- 000 lb./yr. at approximately \$2.50/lb.

▶ Flavors, Perfumes—The 1958 volume-price limit for flavors and perfumes is 400,000 lb./yr. at about \$1.10/lb. There are no points in the exclusion area for 1958.

Good working limits, based on available data, for flavors and perfumes would seem to be around 500,000 lb./yr. at \$1.00-1.20/lb.

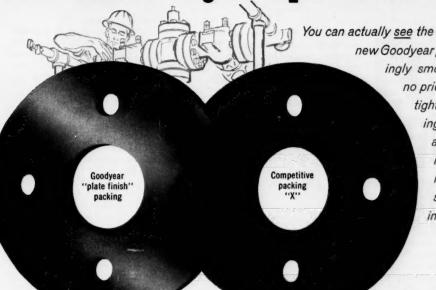
▶ Plastics and Resins—The 1958

data on plastics and resins indicate limits of 3 million lb. and $46\phi/\text{lb}$.

This represents a rather substantial volume change from 1957 when limits were 6 million lb. and $50\phi/lb$. However, it is difficult to obtain an accurate poundage estimate on plastics and resins due to the lack of data on plastics which cost more than $50\phi/lb$.

Epoxy resins—with a production of nearly 34 million lb. and

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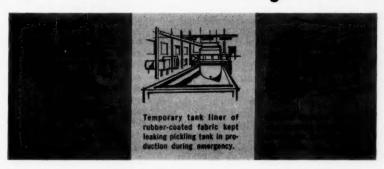
> ingly smooth "plate finish" - at no price premium-assures a tighter seal with less sealing pressure. And that's in addition to exceptional resistance to aging and hardening, thanks to the superlative compounding of top-grade rubbers.

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aplate – T. M. Goodyear Tire & Rubber Company, Akron, Ohio

THE GREATEST NAME IN RUBBER

a price of 64¢/lb. in 1958—are the only products, for which production data are reported, that violate the exclusion principle. But epoxy resins' unusual properties in adhesion and upgrading paint oils have been described many times.

Exclusion limits for plastics and resins in previous years are shown in the table on page 116. Only a cost estimate is avail-

able in some cases.

Good working limits for these materials: Production of about 5-10 million lb./yr. at 50¢/lb.

Complete Data?—There is one question often raised about the use of the exclusion chart as a method of correlation: "Does the sum total of all the products plotted on the chart represent a major share of total plastics

produced?"

With the 1956 Tariff Commission report, a slide rule, a pencil and paper, it can be readily established that the total dollar volume for production of plastics and resins was about \$1.3 billion. Of this volume, about \$250 million was covered by such vague categories as "All Other" and "Materials for Which Separate Statistics May Not Be Shown." We chose 1956 data here because our company had excellent figures on all plastic materials not listed by Tariff for that year.

On this basis alone, it is fair to conclude that the data used to prepare the exclusion chart for plastics and resins for 1956 represented over 80% of the total dollar volume of produc-

tion for that year.

This representation is not bad in itself, but let's look more closely at two of the vague categories which together represent a total value of \$170 million out of the \$250 million previously unaccounted for.

Performance Counts Most—The first item—\$126 million—covers the value of plastics like nylon, acrylates, methacrylates and fluoroplastics. Rough calculations, using our data for 1956 production of these four materials, indicate that these four plastic classes account for over 90% of the \$126 million and that they all fall within the exclusion area. And well they

might, for they are unusual products used because of their unique properties, with cost secondary to performance.

The second item—\$42 million—is made up principally of polyvinyl butyral and formal, whose properties are also so unique that their cost is secondary to performance.

Thus, when these two items are considered, only plastics and resins with a value of \$80 million out of a \$1.3-billion total remain unaccounted for. And the average values of these materials do not violate the exclu-

sion principle.

▶ Plasticizers—Exclusion limit for plasticizers in 1958 was about 2.7 million lb./yr. at 31¢/lb. There are three points in the exclusion area—two of them representing sebacic and azelaic acid esters. These esters find uses as synthetic lubricants as well as plasticizers, hence their volume-price relationship is not the same as commonly associated with plasticizers.

The third point is for dicyclohexyl phthalate which appeared in the 1957 chart for the first time. This product is used primarily as a plasticizer for nitrocellulose coatings on moisture-

proof cellophane.

From data for 1958 and previous years, an exclusion limit of 2.5 million lb./yr. at 30-35¢/lb. appears to be a good working estimate for plasticizers.

Surface-Active Agents—Exclusion volume-price limit for surface-active agents in 1958 was 3 million lb. at 39¢/lb. This seems to be a good working estimate for the future.

Most of the products which have pushed the price limit up from the earlier 20-28¢/lb. (see table, page 116) were derived either from ethylene oxide or from various amines. Here is an example of the changing cost pattern that can and does occur for a specific end-use category. ▶ Pesticides—Pesticide limits in 1958 were about 5.5 million lb. at 49¢/lb. There are no points which fall into the exclusion area.

► Rubber-Processing Agents— Because of insufficient published data, a chart showing exclusion limits for rubberprocessing chemicals in a single year would be of questionable value. Therefore, we chart production-price data for this class of materials on the basis of data for the years 1954-1958.

It appears that 4-6 million lb. at 50-60¢/lb. is a good estimate for a product in this classification. There are no points in the exclusion area.

➤ Miscellaneous Chemicals—Exclusion limits for miscellaneous chemicals in 1958 were 7 million lb. at 30¢/lb.

There are four chemicals that fall into the exclusion area: sodium carboxymethyl cellulose, 2,6 ditertiary butyl p- cresol, and two chlorofluorocarbons. (Data on the latter were reported first in 1958.)

It is surprising that any amount of correlation is obtained for this miscellaneous classification. However, many of the chemicals have somewhat the same end uses-either as low-cost aliphatic intermediates or as solvents. Those that fall within the exclusion area have very specific uses because of unusual properties: carboxymethyl cellulose in detergents; ditertiary butyl p- cresol as an oxidation inhibitor; and chlorofluorocarbons as aerosol propellants and refrigerants.

Exceptions—The Tariff Commission also publishes data on three other end-use categories: elastomers, lakes and toners,

and dyes.

There is an insufficient number of elastomers reported by Tariff to provide any chart of the type we have been discussing. And dyes, lakes and toners do not show an exclusion area in the manner just described. A plot of reported materials shows a continual gradual decrease in production as the price rises.

HERMAN ZABEL, executive vice president of Roger Williams, is a chemical engineer with a varied career. Some jobs: research engineer, teacher, business paper editor, product developer. He has a BS from Kansas State College, a MS from Columbia.

MICHAEL MARCHITTO, a market analyst with Roger Williams, joined the firm in 1955. He has a BS in chemistry from Seton Hall.



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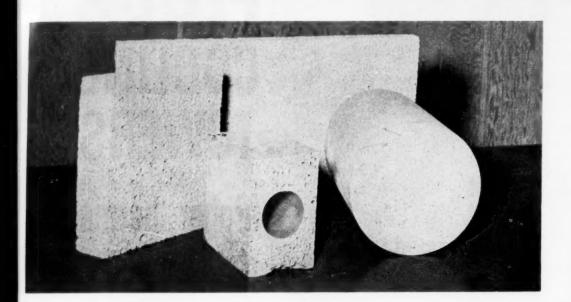
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DEVELOPMENTS ...

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Foamed Al, New Structural Material

Fire- and waterproof, light, insulating and acoustical material aims first at building construction. Next come chemical plants, aircraft, autos, packaging.

World's first commercial facility for foamed aluminum will go into production next month.

Compared with many common structural materials, thinner, lighter sections of the foam offer better insulating and acoustical properties at lower costs. Producers have sights on markets ranging from water skis to casket frames, automobile muffler aids to engine floats for aircraft and rockets, outdoor signboards to oil storage tank covers in refineries and chemical plants.

Product is corrosion resistant,

fireproof, waterproof, extrudable

terial is in built-up roofing and building panels.

In roofing, the foam can be used as a 1-in. base on which in-

or moldable, can be machined,

sawed and nailed, bolted, glued,

bent or pressed into shape. Called Alumafoam, it can be

bonded to anything by means of

epoxy adhesives. At 12 lb./cu. ft.

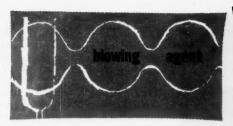
density vs. 170 lb. for aluminum

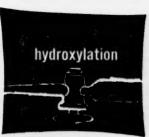
First use and sales of the ma-

itself, the foam floats.

used as a 1-in. base on which insulation and asphalt-type coverings can be built up. An estimate made by one roofing manufacturer places cost of the cheapest type of presently available roof, using a 3-in.-thick deck structure of concrete, wood, steel, etc., at \$1.85/sq. ft., compared with \$1.34 for roofing incorporating the new foam. The two roofings figuring in the estimate each totaled 3 in. in thickness, but the over-all coefficient of heat transfer of that containing aluminum foam is 0.19 compared with 0.33.

Licensed under the basic patents for the foaming of metals obtained by the Bjorksten Research Laboratory, Madison, Wis., Dynamic Metals, Inc., is now building a plant with an

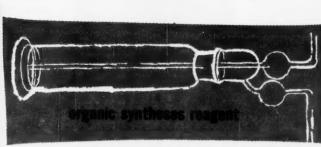






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initial capacity of 5.5 million lb./yr. of foamed aluminum. Upon completion of performance tests on the new plant, design data will be available for construction of a full-scale production plant having a capacity of 20 million lb./yr. of Alumafoam. With this on stream, the original plant will be turned to research and development on new end products.

Foamed aluminum is made by mixing zirconium hydride with molten aluminum. Dynamic Metals say the offering price will be in the 75¢-\$1/lb. range, for a sq. ft. of 1-in. thick material. Since the density is 12 lb./cu. ft., this is also the per-pound price of the foamed aluminum.

This price is for Alumafoam 220, which a standard aluminum alloy 220, made up of 90% aluminum, 10% magnesium plus a trace of zirconium coming from the foaming process. The company is now experimenting with Al-Mg-Si alloys, which should bring the price down since silicon is cheaper than magnesium.

Company can foam any alloy of aluminum as well as pure aluminum. Thus, product can be tailor made to suit strength or corrosion properties. — Dynamic Metals, Inc., Houston, Tex.

Styrene-Acrylate

For more gloss in floor polishes, at less cost.

New styrene-acrylate copolymer develops exceptionally high gloss so that floor polishes can be compounded at lower solids than acrylic formulations while retaining the same gloss characteristics. Called U-4001 Ubatol, it is said to bring together the flexibility and clarity of an acrylate with the gloss and toughness of a styrene.

Priced in the same range as modified polystyrenes, it can be used in both buffable and nonbuffable floor polishes. It is completely compatible with common waxes, resins, and polymers and can be formulated into a nonpowdering floor polish.—
U B S Chemical Co., Cambridge, Mass. 122A



Glass Paper

New films combine resistance to 500 F., with controlled porosity, strength.

A new family of films said to combine extraordinary tensile strength with maximum flow rate and extremely fine pore size has been introduced for industrial filtering applications and electrodialysis. Called Amfab, the film is a woven glass fiber fabric integrated with microscopic glass fibers between the threads and impregnated with Teflon resin.

► High Strength—Strength runs from 7 to 75 lb./in. width, porosity from less than 1 to 75 microns, thickness from 0.001 to 0.25 in.

Amfab's glass fiber blend

plus the Teflon coating allow its use where a combination of filter paper and wire screen, or filter paper and cloth filter backing or where porous ceramic filters have heretofore been used. In addition, Amfab is designed to serve in a variety of filter presses and other devices where wet strength, resistance to bursting and active chemicals are of utmost importance. ► Rugged Service — So far applications studied include stack filters; pharmaceutical processes filtration; filter press membranes; filters for coffee brewing; alcoholic beverages manufacturing such as beer; filtration of petroleum and other heavy products such as soaps and varnishes; and swimming pool filters.

In addition to its porous form, Amfab is also available in nonporous form for use as insulation, and for mold release for use in plastics manufacturing operations.

On a modified Fourdrinier paper making machine, slurry of glass fibers is made to matt on a woven glass screen, instead of the conventional Foudrinier metal screen. Glass screen becomes an integral part of the finished product and gives it its unusual strength. Part of the job in developing the production process was learning to control pore size, uniformity, thickness.

Amfab's Teflon coating makes it resistant to caustic solutions,

Newsworthy Chemicals-

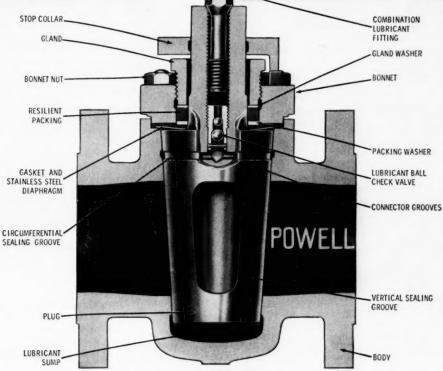
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Foamed aluminum, new structural material	120A
Styrene-acrylate copolymer adds gloss to floor polishes	122A
Glass papers for filtering are strong, heat resistant	122B
Viscosity modifier for epoxies promotes wetting	124A
High temperature lube for use in kilns, drying ovens	124B
Blowing agent for plastics, rubber works to 220 C	124C
Dyes set new standards of fastness for nylon coloring	124D
Radiation resistant rubber designed for nuclear reactors	124E

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POWELL

LUBRICATED PLUG VALVES



Sectional view Powell Screwed Gland Lubricated Plug Valve.

Like all Powell Valves, Powell Lubricated Plug Valves are superior in their field . . . and have many advantages over other conventional types of Valves.

- Simple design: only three basic parts—Body, Bonnet, Plug.
- Quick, complete shut-off—a quarter turn will close or open the valve.
- Tapered Plug assures positive seating.
- Machined surfaces of plug and body are not exposed in the open position. Any media adhering to the plug when in the closed position is removed when plug is rotated.
- Cavity-free straight passage assures streamlined flow in either direction. Scale and sediment cannot collect.

Powell Lubricated Plug Valves are available in sizes ½" through 16", depending on the type required—Semi-steel 175 and 200 pounds WOG;—Carbon Steel ASA 150 and 300 pounds.

Powell can also furnish Lubricated Plug Valves in other alloys on special order.

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acids, alkalis and other chemicals that immediately destroy filter paper. And it is unaffected by long periods of exposure to temperatures up to 500 F., so that it can be immersed in boiling water, autoclaved, or sterilized in ovens.

It is produced 38 in. wide in 1,000-ft. rolls. Cost ranges between 25¢ and \$1.50/sq. ft.

Sister Product—A second new film, this one for laboratory use, consists of tiny borosilicate glass fibers made into a thin uniform sheet and then impregnated with Teflon. Its strength is rated at 3.5 lb./in. of width, even when wet, so that it can withstand for long periods pressure and handling that would at once destroy ordinary laboratory filters. Because the fibers are impermeable, they do not swell up like cellulose fibers which changes the porosity characteristics of the filter.

Called Fiberfilm, it is formed into sheets 0.0006 to 0.018 in. thick and coated with Du Pont's Teflon or Dow Corning's Sylkyd. Pore sizes are controlled from 5 to 100 microns. — American Machine & Foundry Co., Springdale, Conn.

Terpene Derivative

Viscosity modifier for epoxies promotes penetration and wetting.

Terpox viscosity modifier, a new reducing agent for use with epoxy resins is being introduced in development quantities

Applicable to both amine and anhydride cured epoxy systems, it promotes penetration and wetting in the system, and permits increased filler loading of epoxies for potting, casting, laminating, coating, adhesive formulations, body solders, as well as concrete patching compounds.

Terpox is a difunctional oxy derivative of a terpene. It is a light-colored, low-viscosity liquid of pleasant odor, readily miscible with epoxy resins at room temperature.

In amine cured systems, with diethylene triamine, a relatively small quantity of Terpox provides very fluid systems for cases where heat distortion requirements are now paramount.

Amine-Cured System

1	Epoxy (epoxide equiva- lent-200), parts100	100	100	100
1	Terpox 0	10	10	20
]	Diethylene			
	triamine 10	10	15	15
,	Viscosity, cps. @25	760	500	435

Anhydride cured epoxies modified with Terpox exhibit little loss of weight during heat curing cycles, and involve a minimum sacrifice of heat distortion performance.—Heyden Newport Chemical Corp., New York. 124A

Lubricant

Withstands high temperatures of drying ovens, kilns.

A new aluminum magnesium silicate compound provides oven and kiln operators with lubrication, where needed, which can withstand the torch-like temperatures necessary in manufacturing bricks, ceramics and certain other chemical, glass, metal as well as lumber products.

Called Almasol 1250, it will withstand heat up to 1,900 F., is disposed to remain chemically stable inside drying ovens and kilns. It is thereby able to provide lubrication and protection never before possible for roller bearings in dryer cars or other subjects exposed to the heat.

Almasol is similarly absolutely impervious to acid. The layer bonded to the metal surface serves as a permanent shield against damage from acid corrosion.

Whereas petroleum lubrication films will be destroyed by the high temperature operation of the drying ovens and kiln, the Almasol film is unaffected because of its ability to remain unchanged in quality to 1,900 F.

When compared with other layer lattice solids, Almasol also has certain inherent advantages.

It can withstand greater pressures than graphite. By virtue of its chemical inertness, it does not undergo reactions with fer-

rous metals as does molybdenum disulfide. And being inert and water insoluble, it does not introduce corrosion problems as does cadmiuum iodide.—Lubrication Engineers, Inc., Fort Worth, Tex.

BRIEFS

Blowing agent for the plastics and rubber industries is said to decompose higher than any nitrogen-releasing agent presently available. This permits processing of compounds containing the compound, called Expandex 177, at temperatures up to 220 C. without danger of premature blow. Product is expected to be widely used with high melting polymers such as linear polypropylene, high density polyethylene, nylon 6. - National Polychemicals, Inc., Wilmington, Mass. 124C

Dyes for nylon are said to provide standards of fastness and quality hitherto obtainable only on wool and cellulosic fibers. Called Procinyls, the new dyes contain reactive groups in their molecules which react with the amine or amide groups in the polyamide fiber.—Imperial Chemical Industries, London, England.

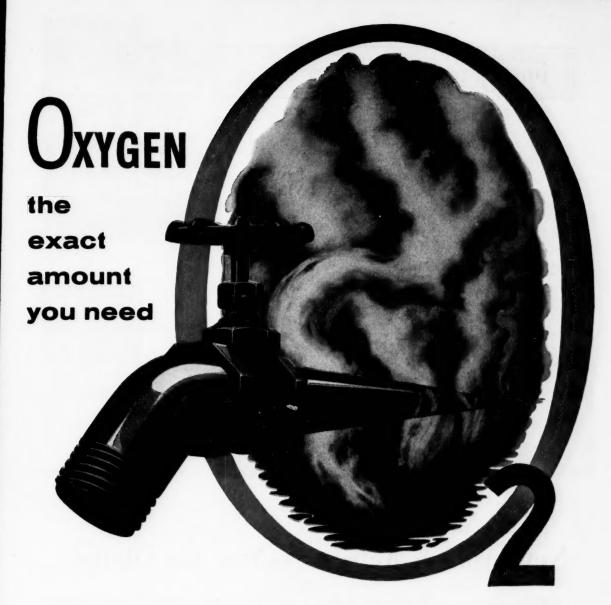
Radiation resistant rubber has been developed for application in the fabrication of pneumatic seals for nuclear reactors. Designated as Presray Compound No. 1704, it retains a high degree of its original characteristics when exposed to radiation. — Presray Corp., Pawling, N. Y. 124E

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PROCESS EQUIPMENT EDITED BY C. C. VAN SOYE



New Analog Actuator—May Go Digital

Another valve operator joins list of mechanisms for electronic process control. This one—a stepping motor—will obey either analog or digital commands.

Analog control now, digital later... maybe. That's the application pattern foreseen by Fischer & Porter Co. for their new electrical valve actuator.

F & P engineers developed this novel unit to respond either to digital pulses from computers or to analog signals from conventional electronic instrumentation. But digital computers have not yet assumed any more than a walk-on role in process control, so final digital adaptation of the actuator must wait. In the meantime, however, the analog adaptation should prove quite useful in a wide variety of control applications.

► Principle of Operation — Essentially, the actuator is a large

stepping motor. Three separate magnetic fields, which are energized in sequence in response to commands from the controller (or computer), act on an 18-tooth rotor. (Illustration partially shows drive mechanism.) Each turn of the rotor results in a corresponding lineal motion of the valve stem.

Four parallel-connected actu-

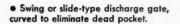
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Specially designed to give top mixing efficiency and meet sanitary codes



Rounded tub ends prevent material hang-up, neoprene cover-seals provide dust-tight fitting.





- Unique coupling permits vertical removal of agitator assembly without disturbing shaft ends and bearings.
- Heavy-duty, outboard anti-friction bearings.
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- Dust-tight covers, with quick-action clamps.

Top mixing efficiency with the new Strong-Scott Ribbon Blender mixer on dry or semi-dry materials, has been proven through continuous testing. The Ribbon Blender also meets requirements of health codes where necessary.

The ability to thoroughly and quickly mix is provided by a unique "ribbon assembly." The smallest amount of additives are thoroughly mixed in a matter of minutes. Special smooth-surface, cornerless welding and rounded corners throughout, leave no place for material to gather. The cover is seal-tight for maximum cleanliness and dust control.

Nine different size units ranging from 16 to 300 cubic feet working capacity are available in stainless steel or carbon steel. Jackets for heat transfer mediums also available.



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MI- C-

451 Taft Street N. E., Minneapolis 13, Minnesota

Discharge modifications made to suit installation.

ating coils, when energized, form each of the magnetic fields. Rotation results when a coil is "turned on" because one of the rotor's teeth tends to align itself with the magnetic field. When this happens, however, another tooth reaches a position that causes continued rotation when the second-phase field is energized.

Operation of any phase moves the rotor one-third of a step. Since the rotor has 18 teeth, each complete revolution requires 54 steps. Actually, a refinement of this arrangement is used: By overlapping the coils' operation, the number of discrete steps jumps to 108.

Through sequential operation of the three sets of phase coils, the rotor moves continuously, with a direction depending on sequence of coil operation.

Signal Input to Coils—When controlled by analog signals, a servo motor sets the pattern of coil energization. The servo positions a magnetic commutator that opens or closes switches, completing coil circuitry as required. A differential transformer performs as the feedback mechanism.

If and when computers supply the control signals, an electronic counting device will accept the digital pulses and energize the coils accordingly. Number and direction of pulses will determine valve position. With this system, the process itself will act as the feedback loop to the computer.

▶ Performance Data — With lead-screw linkage, the actuator delivers about 500 lb. of thrust at a travel speed of 0.2 in./sec. Input power is 160 w. for actuation, 40 w. standstill.

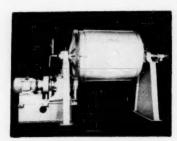
If input power fails, the rotor locks in its last position.
A handwheel on top of the casing permits manual valve operation.—Fischer & Porter Co., Hatboro, Pa. 126A

Pilot Centrifuges

Relatively inexpensive research tools offered.

Small-sized versions of Westfalia automatic De-sludger and Nozzle Separator centrifuges have been introduced for pilot-scale operation.

One unit handles solid contents up to 20%; the other is designed for liquid mixtures with up to 5% solids. Both machines have all of the operating characteristics and advantages of the manufacturer's commercial-size units.—Centrico, Inc., Englewood, N. J. 128A



Ball Mill and Reactor

Specially designed to serve dual process role.

A new tool for performing multiple operations in a single processing unit, the Mil-Reactor, combines the functions of a ball mill and a reactor.

One function is grinding under controlled pressure and temperature conditions. Also, access lines permit addition of liquids, slurries or gases for reaction while the mill is in operation. Vapors may be removed during solid-drying cycles.

Mil-Reactor comes in sizes from 5 to 500 gal. working capacity. Internal pressures can range from full vacuum to 50 psig. The heating and cooling jacket is suitable for pressures to 125 psig.—The Patterson Foundry & Machine Co., East Liverpool, Ohio.

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Hinged Closure

Has built-in safety feature. Available in many sizes.

Applications cited for new hinged closures include installations on shell-and-tube heat exchangers, tanks, filters and reaction vessels. The one-man closure is a complete assembly consisting basically of a hub that is installed via a single circumferential weld, plus a hinged cover or cap that clamps readily within two yoke halves. Sizes produced vary from 2 to 42 in. for ASA 150-, 300- and 600-psi. service. Larger sizes and other pressure classes available on special order.

According to the manufacturer, a single operator can easily and quickly open the closure with a standard wrench. The closure cannot be opened until pressure behind the cover is relieved.—Tube Turns Div., Chemetron Corp., Louisville, Ky.

Tube Protectors

Plastic inserts stop erosion of tube ends.

Tube protectors extend the usable life of old condenser and heat exchanger tubing, and greatly increase expected life of new tubes. The new components stop erosive conditions from causing wear and damage to the inlet section of any tubing.

Each protector consists of a short length of plastic tubing, flared at one end to provide a venturi entrance for process fluids. The inner wall gradually tapers toward the discharge

BUILD SPECIAL PROPERTIES INTO "TAILOR-MADE" POLYMERS WITH VINYLPYRROLIDONE

ONTROLLED SOLUBILITY

DYE RECEPTIVITY

EMULSIFICATION

SURFACE ACTIVITY

ADHESIVENESS

STRENGTH

COMPLEXING ACTION

These are some of the many properties which may be "built into" copolymers to meet specific needs.

Vinylpyrrolidone, a versatile liquid monomer, copolymerizes readily with other monomers. Vinylpyrrolidone also reacts with phenols to form valuable addition compounds.

Vinylpyrrolidone offers a new approach to a wide variety of polymeric products, including synthetic fibers and films, lube oil additives, adhesives, coatings and finishes, glass-fiber laminating resins, and textile sizes.

If you work with copolymer systems, see what Vinylpyrrolidone can mean toward product improvement.

For additional information on handling properties impolymenization procedures, etc., wide for Bulletin No. AP 86.

from Research to Reality



end to provide minimum fluid turbulence.

Material of construction can be either nylon, polyethylene, or phenolic resin. Sizes range from \$\frac{1}{2}\$ in. x 18 BWG to 2 in. x 8 BWG. Lengths run from 2\frac{1}{2}\$ to 6 in.—Crane Packing Co., Morton Grove, Ill.



Felt Insulation

Many densities and surface facings offered.

Made from spun mineral fibers with a phenolic resin binder, a new line of insulating felts is applicable to operating temperatures from below zero to 450 F. If mechanically supported and enclosed, the line will prove satisfactory to 600 F.

Light in weight and resilient, the felt insulation is incombustible, noncorrosive and moistureresistant. It is easy to cut and fit with a knife or saw.

Densities vary from 3 to 8 lb./cu.ft. Thermal conductivities range upward from a minimum of 0.24 Btu./(sq.ft.) (hr.) (deg. F.). A variety of facings and coatings provide application flexibility. Thicknesses vary from 1 to 4 in. in ½-in. increments.—Baldwin-Ehret-Hill, Inc., Trenton, N. J. 130A

Pressure Detectors

Convert pressure directly to resistance value.

New resistance-type pressure detectors are available for measurement of gas, liquid or vapor pressures in combination with the manufacturers Omniguard monitor.

In operation, Model 328 RPD pressure-sensing element linearly varies the terminal resistance of an alloy winding having a low temperature coefficient. For pressures under 30 psi., a precision capsule is the sensing element. From 30 to 3,000 psi., special Bourdon-tube elements are used.—Thomas A. Edison Industries, West Orange, N. J. 130B



Analysis Accessory

Converts spectrophotometer to polarimeter.

Rapid, highly accurate analysis of compounds whose molecular structure differs only in the spacial arrangement of the same atomic elements can be achieved with UV spectrophotometers by means of the new ORD accessory. This device permits qualitative and quantitative evaluation of steric compounds by measuring their unique and characteristic effect upon polarized energy.

ORD attachments convert double - beam spectrophotometers into recording polarimeters by substituting some polarimeter components for the sample holders in the spectrophotometers. The components consist of a fixed polarizing calcite prism, a sample area and an analyzer prism.

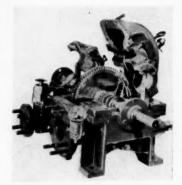
Designed for use with Perkin-Elmer Model 4000-A spectrophotometers, the device is also compatible with P-E Models 4000 and 3000, and with Cary Models 10, 11 and 14.—Perkin-Elmer, Norwalk, Conn. 130C

Gas Meters

High-pressure units for process monitoring.

Spanning a measurement range from 7 to 38 million scf. per 24-hr. day at maximum pressure, a new line of high-pressure meters for process gases is unaffected by pulsation or line surge. Accuracy of the four available sizes is $\pm 1\%$ throughout a flow range from 10 to 100% of rated capacity.

Flanged inlet and discharge connections simplify mounting in horizontal pipe lines. Welded and bolted steel housings.— Roots-Connersville Blower, Connersville, Ind. 130D



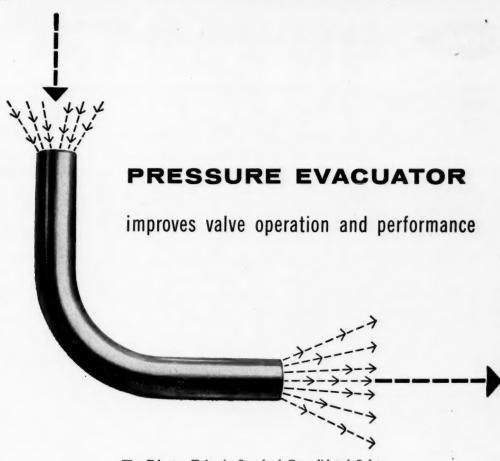
Steam Turbine

Shaft mounting minimizes radial misalignment.

Designed to minimize problems of radial misalignment, the new Centerline-Mounted steam turbine is offered in a complete range of frame and wheel diameters for requirements to 1,000 hp. Steam pressures can vary to 875 psi.

Frequently, unequal expansion of the metal in a turbine and that in the driven machine results in radial misalignment between the two units. Because the shaft of the new turbine is

EQUIPMENT NEWS
Continues on Page 244





Consolidated Safety Relief Valve, Type 1900 Series, Sizes: 1" x 2" to 8" x 10".

The Eductor Tube in Standard Consolidated Safety Relief Valves is a pressure evacuator. It efficiently removes pressure from the closed bonnet. If allowed to remain in the bonnet, the pressure would act on the top of the disc and tend to limit the lift and induce cycling. But with the pressure evacuated from the closed bonnet through the Eductor Tube, the spring alone controls valve action. Consequently, *reliable* valve action and guaranteed capacity ratings are attained. A new high in operational dependability is assured.

Reliable operation and performance of Consolidated Safety Relief Valves are your assurance of absolute protection for personnel and equipment. "2 in 1" design permits you to convert the Standard valve to the Bellows type in your own shop. But that is only part of the total economy of these modern valves. Get the complete inside story. Write for Catalog 1900.

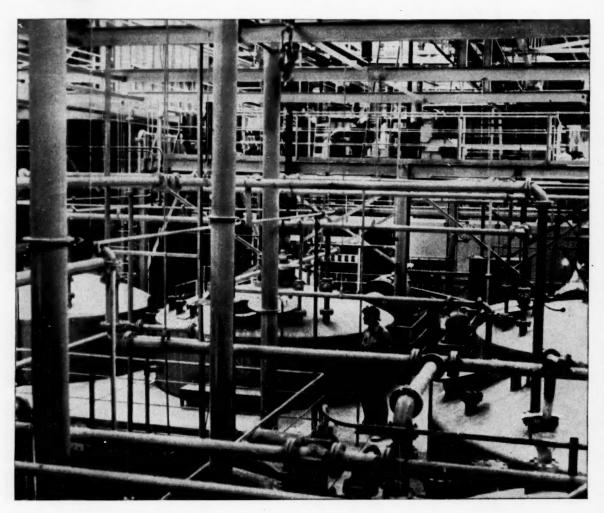


CONSOLIDATED SAFETY RELIEF VALVES
A product of
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Tulsa, Oklahoma In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario



SARAN LINED PIPE



Saran Lined Pipe . . .

process lifeline with a hot acid cargo

When a complex piping system carries corrosive process liquors . . . when it must withstand constant thermal stress imposed by its high-temperature cargo . . . corrosion resistance and high physical strength are the keys to pipeline dependability.

The maze above is of Saran Lined Pipe, and is a part of the process piping at American Cyanamid's Savannah plant, Savannah, Georgia. Most of this pipe carries process liquors with a sulfuric acid content of 25% . . . at temperatures of 165° F. and above. Pumping pressures range upward to a maximum of 70 psig.

The chemical activity and high temperatures of the pipe's contents are severe threats to pipeline durability, but thanks to the extreme corrosion resistance and high strength of Saran Lined Pipe it has performed dependably for Amer-

ican Cyanamid since installation four years ago.

Similar sections of Saran Lined Pipe carry hydrochloric acid in concentrations as high as 37%, while others are used to transfer 10% caustic soda. In many areas other types of corrosion resistant piping have been replaced with new Saran Lined Pipe, with highly satisfactory results.

When processing systems require piping that must resist corrosion and chemical activity, under a wide variety of conditions, consider dependable Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can be cut, fitted and modified easily in the field without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Department 2280AK10-19.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

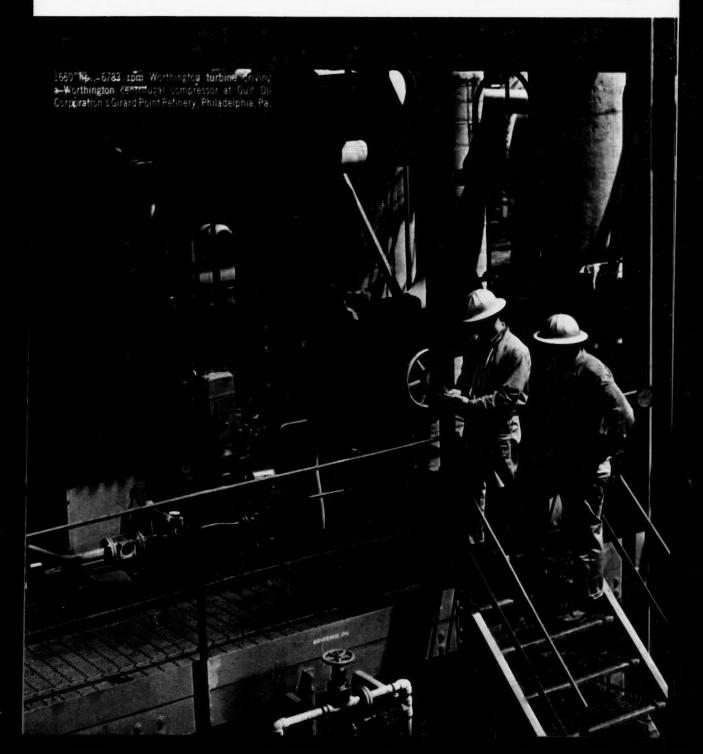
1,257,643 HP

OF WORTHINGTON TURBINES
NOW DRIVING EVERY
MAJOR MAKE OF
CENTRIFUGAL COMPRESSOR

More than a million hp of Worthington compressor-drive turbines (and this includes only centrifugal compressor-drive turbines) are now operating around the world. This includes the largest petrochemical unit (we build them up to

50,000 hp), and the fastest (15,000 rpm). There's a "priceless extra" in every Worthington high speed turbine that's behind this remarkable acceptance.

To find out what it is, turn the page

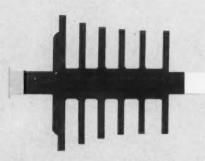


RELIABILITY

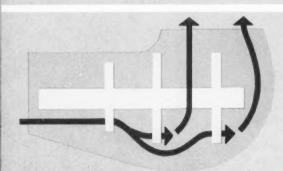
THE PRICELESS EXTRA
IN EVERY WORTHINGTON
HIGH SPEED TURBINE

Reliability is the ultimate goal of every step that Worthington takes in the design and manufacture of compressor-drive turbines. Reliability is the reason for six extra-quality features shown below. Reliability is the end result of infinite attention to engineering detail based on our 32 years experience in this specialized field. Reliability is the reason Worthington load-tests all multi-stage machines. Reliability is the priceless extra—the single most important reason why more compressor-drive turbines, driving all major makes of compressors, have come from Worthington than any other builder. Worthington Corporation, Wellsville, New York.

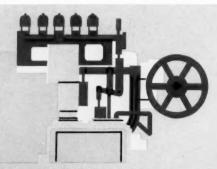




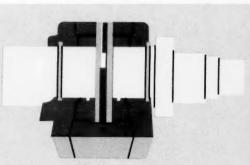
SOLID ROTORS—wheels forged integral with the shaft—provide a more rugged, conservative design.



DOUBLE-FLOW EXHAUST—the last stage is divided into two wheels—reduces blade length, increasing efficiency.



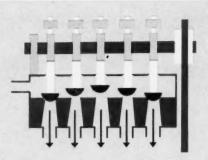
SENSITIVE SPEED GOVERNING SYSTEM provides close control over a wide speed range. (Governor takes air impulses from an outside controller to vary speeds.)



KINGSBURY-TYPE THRUST BEARINGS withstand heavy thrust loads. Shoes pivot, forming a wedge-shaped oil film between thrust collar and bearing surface.



ANTI-OIL-WHIP BEARINGS keep vibration to a minimum. An oil dam in upper half of bearing builds up a pressure pad, keeping rotor firmly in place.



CAM-OPERATED AUTOMATIC NOZZLE CONTROL. Each valve, with separate cam, controls a group of nozzles for maximum economy at all loads.



... DRY

JET FUELS

Jet aircraft now get a new and wider safety margin when their fuels are dried with LINDE Molecular Sieves. Even at high fuel flow rates, water normally absorbed at ground level is reduced to less than 10 ppm—eliminating ice-blocked fuel lines at high altitudes.

Liquids never before dried-successfully by desiccants can now be dried commercially with these new zeolite adsorbents. Examples are acetone and other ketones, ethanol and other alcohols, and most saturated and unsaturated hydrocarbons. Drying to less than 1 ppm is now practical in dynamic systems. Due to their high water adsorbing capacity, LINDE Molecular Sieves bring pronounced savings in investment and operating costs.

No matter what the liquid – whether attempts to dry it have succeeded or failed we would like to discuss with you what a Molecular Sieve design can do.

Write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Address Dept. CE-102.





UNION CARBIDE

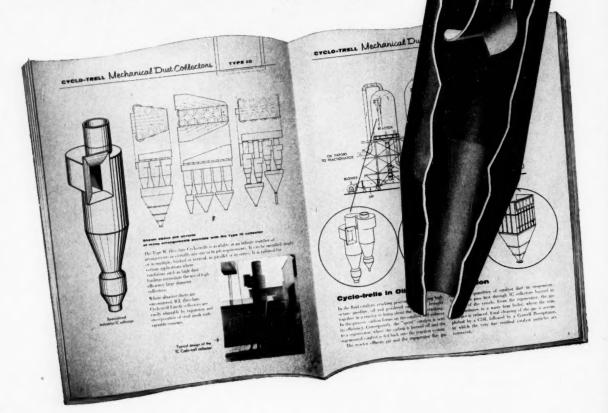
New CYCLO-TRELL MECHANICAL DUST COLLECTORS

These new Cyclo-trells can be built to fit any specific job.

Available in Types C-10 (10" diameter), C-24 (24" diameter),

IC (involute Cyclo-trell), ICL (involute Cyclo-trell, lined) and

C-24-L (24" lined). Also available: a new hopper discharge valve.



Write now for your copy of new Bulletin 300 which gives details and illustrations of the new Cyclo-trells and hopper discharge valve.

Research-Cottrell, Inc.

Main Office and Plant: Bound Brook, New Jersey REPRESENTATIVES IN PRINCIPAL CITIES OF U.S. AND CANADA





Standard heat exchangers are suitable for a wide range of services, including heating, cooling, vaporizing and condensing, with the maximum usefulness in the smaller sizes

Standardization of mechanical design and price offers many important advantages to the user.

Savings may be realized in the user's engineering time, due to ease in procurement, inspection of fabrication, checking drawings and construction details.

In plant layout work, the size of the unit can be quickly established, and the complete information available

allows exact details to be fixed at once.

Immediate delivery on most units often results in important savings, due to early completion of the project. Interchangeability allows reuse of the equipment in other services, and increases salvage value.

Important cost savings are available to the user, due to economies in manufacture.

Savings to the process industries, by heat exchanger standardization, are estimated at several million dollars annually.

Struthers Wells has just issued a new bulletin, giving complete mechanical design and prices, covering a number of standard sizes, to about 1200 square feet of surface, and in six principal types.

Thermal design data are included in the bulletin, to allow the user to fix the size of the required unit, in various services.

A large stock of standard exchangers allows immediate shipment, in most sizes. Equipment is available in carbon steel, also with non-ferrous tubes, and in stainless Types 304 and 316.



to the selection of a standard SW Heat Exchanger is contained in Bulletin B-20. Write for your copy today

STRUTHERS WELLS CORPORATION WARREN, PA.

STRUTHERS WELLS PRODUCTS PROCESSING EQUIPMENT DIVISION

Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

BOILER DIVISION

BOILERS for Power and Heat
... High and Low Pressure
... Water Tube ... Fire
Tube ... Package Units

FORGE DIVISION

Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls



FEine Rotary Vacuum String Discharge Filters

FOR THE HUBINGER COMPANY .

STRING DISCHARGE FILTERS solved the problem

These FEinc rotary vacuum filters were recently custom built to specifications for The Hubinger Company, Keokuk, Iowa. The job they're doing is a tough one . . . filtering gluten derived from the wet milling of corn.

The string discharge design was selected as the only workable method for cleanly removing the thin, high-protein gluten cake which causes scraper filters to bog down. Each unit has over 500 square feet of filter area.

LOW MOISTURE CAKE CONTENT

Operating continuously, these string discharge filters eliminate blow-back and produce a cake of low moisture content. Stainless steel construction helps maintain product purity according to standards established in over 75 years of starch production.

The FEinc filters in this installation are examples of how custom-made units provide solutions to many difficult continuous filtration problems in the chemical processing industry.

For help with your problem, see our insert in Chemical Engineering Catalog or write today, Dept. CEF-1059, for free bulletins and technical advice. Simply state your basic requirements.









CUSTOM DESIGNED CONTINUOUS FILTRATION

The most dangerous solvents in the world pass through this valve!

But it's a safe passage. The ROCKWOOD 34" (Fig. 802) Self-Closing Ball Valve is designed for smooth, leakproof handling of highly flammable liquids. A Rockwood Exclusive!

Take a typical installation at an experimental station of one of the nation's largest chemical companies. Here 36 different solvents, ranging from acetone to xylene, are dispensed from bulk containers. All types of self-closing valves were tried and evaluated for this critical job. None equalled Rockwood for positive performance.

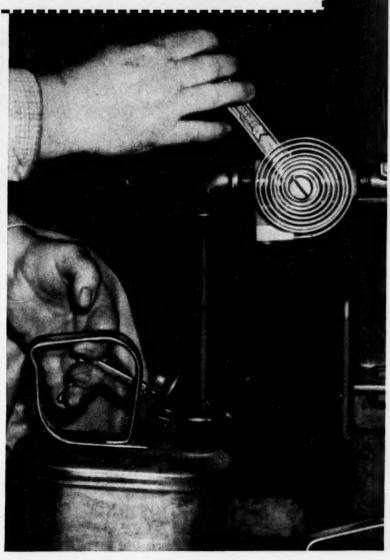
Unique Rockwood Full Round Flow design holds turbulence to an absolute minimum - keeps static at a low level. Flash potential is negligible, greatly reducing fire hazard. In addition, the exclusive "Spring Pressure Compensation" keeps ball and seat in snug contact assures leakproof, dripless shutoff, compensates for wear. Bronze valve body and Teflon trim resist corrosion. After 11 months and 103,200 open-and-shut cycles the company reports: trouble-free operation since installation.

Be as safe and sure with your solvent handling. Send coupon for complete details on the Rockwoop Self-Closing Ball Valve. Tested and listed by Underwriters' Laboratories, Inc.

ROCKWOOD BALL VALVES



Distributors in all principal industrial areas



ROCKWOOD SPRINKLER COMPANY

A Division of the Gamewell Company 264 Harlow Street, Worcester 5, Massachusetts



Please send me complete details on the Rockwood ¾" (Fig. 802) Self-Closing Ball Valve.

Name	 									. ,					 		 								
Title																									
Company																									
Street																									
City																									



This electronic computer can help optimize your marketing, production and equipment efficiency!

World's largest-selling engineering and scientific computer



The Royal Precision LGP-30, marketed by Royal McBee, is today helping create new concepts of operating efficiency in many processing industry applications.

The LGP-30 is programmed and operated by the engineer himself to cut through the maze of mathematical computations demanded for peak-level operations. Some examples of the many tasks this machine is now performing are: simple selection of the severity level of the catalytic reformer; most profitable combination of operations in the production, sale and purchase of gasoline, butane, naphtha; computation of heat balances; vapor-liquid equilibria; process simulation; design of heat exchangers, columns and reactors; crude oil evaluation; product yield structure; blending; economic payout determinations.

The LGP-30 is low in cost-about the price of a good engineer-and is simple to program and operate. Its 4096-word memory is comparable to computers many times its size and cost. User-engineers develop a man-machine relationship to the point where the machine becomes an extension of their own thinking capacity. Bolder, more creative engineering almost always results.

No site preparation is necessary. Plug the LGP-30 into the nearest standard outlet and it is ready to go to work. Customers have access to an extensive library of engineering programs and sub-routines, plus the opportunity to join an active



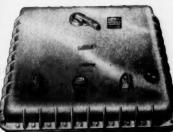
Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. LGP-30 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For complete information on the LGP-30, write ROYAL MCBEE CORPORATION, data processing division, Port Chester, N. Y.

New Aluminum Fittings Added to Killark Line



EXPLOSION-PROOF MOTOR STARTER ENCLOSURES



Designed for your next job calling for motor control equipment. Guaranteed to please you. Made of popular lightweight cast alumalloy—strong and carefully machined for ease of operation and long, trouble-free service. We'll include starter of your choice.

XMS SERIES STARTER

Designed to incorporate standard magnetic across-the-line starter equipment including sizes $0, 1, 1\frac{1}{2}, 2, 3, 4$ and 5.

XMCS SERIES COMBINATION STARTER

Available with starters 0 through 5 with protective circuit breaker or disconnect as required.

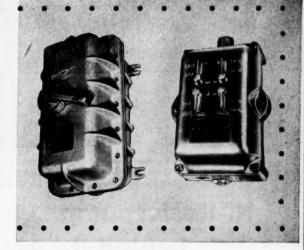
EXPLOSION - PROOF CIRCUIT BREAKER ENCLOSURES

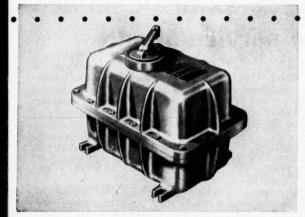
Complete line includes dust-tight and weather-proof as well as explosionproof breakers. Modern, lightweight cast aluminum. All sizes through "LM" Frame. Easy-action handle assembly for smooth, positive operation. Breakers included.

Modern, lightweight cast aluminum housing that requires no maintenance and meets the most exacting installation needs.

XCB Series Breaker Enclosures — All sizes complete through "LM" Frame. We include breakers. Easy-action handle assures smooth, positive operation. Lockout included.

XPCB Series Breaker Enclosures—Will accommodate 4 single pole "quicklag" type breakers, or 2 double pole, or 1 three pole, or any combination not exceeding 4 poles. Amp. ratings through 70 amp.





EXPLOSION - PROOF DISCONNECT SWITCHES

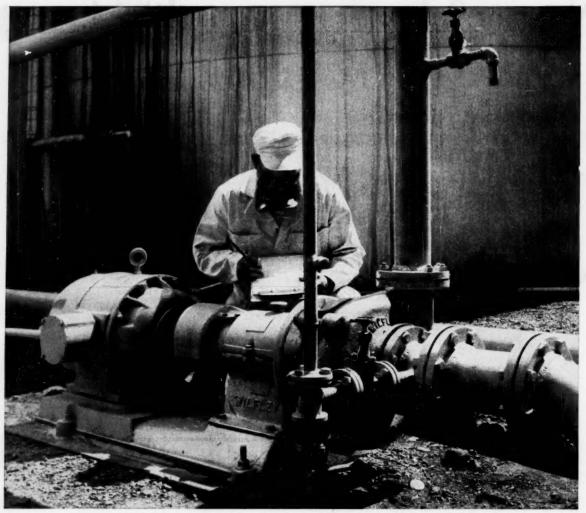
A long-felt need in the electrical industry will be filled by this complete line of disconnect switches (Series XDS). They are available with or without solid neutral, fuseable and nonfuseable, all with convenient mounting lugs. Constructed of lightweight, non-rusting, non-corroding aluminum, they offer a full range of hub arrangements and conduit sizes.

WE WOULD APPRECIATE THE OPPORTUNITY OF BIDDING ON YOUR NEXT JOB



ELECTRIC MANUFACTURING CO.

Vandeventer and Easton Aves. St. Louis 13, M



Operator checks Ni-Resist pump at Pennsalt Chemical's Portland plant. This particular unit was manufactured by A. R. Wilfley & Sons, Inc. of Denver,

Colorado, and pumps caustic at a concentration of 50%. The Duriron Company, Inc. of Dayton, Ohio, also supplied Ni-Resist pumps for the plant.

Ni-Resist pump...eleven years caustic service behind it...years of service ahead

Ni-Resist* pumps have been in caustic service at the Portland, Oregon plant of the Pennsalt of Washington Division, Pennsalt Chemicals Corporation, for eleven years . . .

Eleven years of pumping cell liquor containing 9.3% caustic soda at 170°F to evaporator feed storage . . .

Eleven years of pumping 50% caustic at 80-90°F to storage after concentration . . .

Eleven years of pumping 50% caustic from storage into tanks for shipment.

In regular caustic service, Type 2 Ni-Resist iron offers you proven corrosion resistance. When corrosion resistance plus thermal shock resistance are needed . . . Type 3 Ni-Resist iron does the job.

Equipment parts made of Ni-Resist cast iron stand up to alkalies, acids, salts. They resist erosion, protect product purity. What's more, you have eight Ni-Resist irons to choose from. Each one is a proven engineering material with one or more outstanding properties - pressure tightness . . . extra-low thermal expansion . . . high stain resistance.

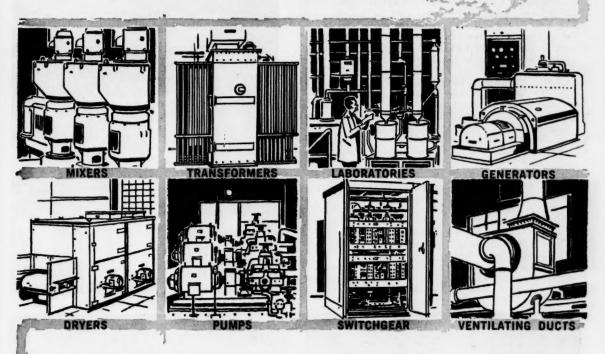
You'll find the answer to your corrosion problem in this family of high-nickel irons. Get all the details. Write for "Engineering Properties and Applications of Ni-Resist."

The INTERNATIONAL NICKEL COMPANY, Inc. 67 Wall Street New York 5, N. Y.

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

Which of these common fire hazards threaten you?





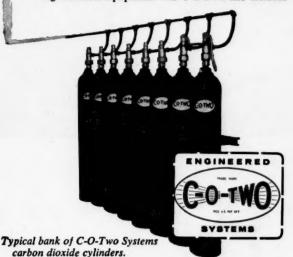
If your plant has one or more of these common fire hazards, ordinary fire protection may not prove adequate! You also need special fixed-type protection that constantly guards specific highly hazardous areas!

C-O-Two Fire Extinguishing Systems are specially designed for closed or partially-closed spaces in which highly flammable liquids or solids are manufactured, handled or stored... or where there is fixed or rotating electrical equipment. The C-O-Two line includes

dependable, high-quality carbon dioxide, dry chemical or foam systems to extinguish fire, plus detecting systems to detect and locate fire automatically.

Your experienced C-O-Two representative is well qualified to carefully analyze all special hazards. Because he offers the industry's largest line of fire protection products and services, he can make equipment recommendations without prejudice. Each C-O-Two System is carefully engineered and manufactured... and C-O-Two will also expertly install the system, if desired.

Why not review your common fire hazards now? If protection is either lacking or inadequate, you can confer at no obligation with your nearby C-O-Two Industrial Fire Protection Engineer! Call him today at these offices:



products of THE FYR-FYTER COMPANY

ATLANTIC COAST REGIONAL OFFICE P.O. Box 750, Newark 1, New Jersey CENTRAL STATES REGIONAL OFFICE 221 Crane St., Dayton 2, Ohio PACIFIC COAST REGIONAL OFFICE 132-140 Hawthorne St., San Francisco 7, California

BRANCHES: Atlanta, Baltimore, Boston, Chicago, Dallas, Dayton, Detroit, Los Angeles, New York, Newark, Philadelphia, Pittsburgh, Portland, Rochester, San Francisco, Seattle, Toronto (Ontario). Representatives and Distributors in all principal cities.

FOAMGLAS® insulation on these methyl ethyl ketone filters cuts insulation maintenance costs

A saving in ketone filter insulation maintenance at the Beaumont, Texas, refinery of Mobil Oil Co. is made possible by the many features of FOAMGLAS insulation.

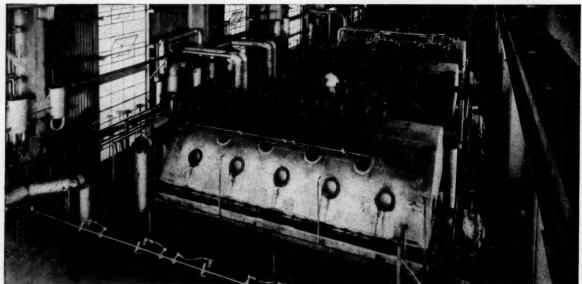
Different operating temperatures for different jobs subject this insulation to constant strain. Filters are chilled anywhere from 40°F. to 0°F., often resulting in ice formation from condensed water vapor. This has damaged insulation materials previously used. But water vapor cannot penetrate the sealed glass cells of FOAM-GLAS. There's no crushing "freeze-thaw" cycle within the FOAMGLAS as there is with organic insulations.

Insulation loses much of its effectiveness when it is waterlogged. Not FOAMGLAS, however. Other insulations tried had required frequent maintenance, while FOAMGLAS remains effective for the six years it has been in use. Extremely easy to work with, easy to cut and shape with any sharp tool, FOAMGLAS is impervious to acid . . . even ketone.

Why not find out more about FOAMGLAS insulation? Write for a sample and for information on our two newest products; FOAMGLAS Stay-Dry Pipe Insulation, and new 134" FOAMGLAS Roof Insulation. Pittsburgh Corning Corporation, Department H-109, One Gateway Center, Pittsburgh 22, Pennsylvania. In Canada: 3333

Cavendish Boulevard, Montreal, Quebec.
Pittsburgh Corning offers a complete line of mastics, tank coatings and other accessory materials specifically designed for use with FOAMGLAS.





The three filters shown above are typical of filters insulated with FOAMGLAS. These 21' by 11' diameter filters, insulated with layers of 2" and 3" FOAMGLAS, separate wax from oil. The refinery, largest in the Mobil system, has a rated capacity of 220,000 barrels per day.

PITTSBURGH



CORNING



Designed to indicate media level changes through simple differential capacitance measurement, the new Robertshaw Level-Tel 154 contains no moving parts to clog, wear or jam.

SIMPLE TWO-STEP CALIBRATION

Only two quick, non-interacting adjustments are necessary to calibrate the new Level-Tel 154.

ANTI-FOULING PROBES

Self-cleaning Teflon probe assemblies remain free of deposit build-up, are unaffected by most cohesive substances.

Built to handle the Tough Jobs!

New Robertshaw CONTINUOUS LEVEL INDICATOR

REMOTE INSTALLATION

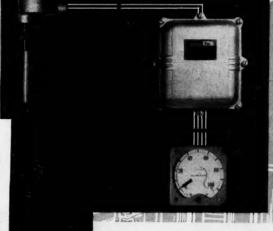
Over 200 ft. cable length permissible between probe and transmitting unit—virtually unlimited cable span between transmitter and indicator unit.

WIDE TEMPERATURE RANGE

Detector circuitry operable in temperature environments from -30° to $+212^\circ \text{F}$. Teflon insulated probes from -325°F to $+350^\circ \text{F}$, Uninsulated probes up to 850°F .

The Level-Tel 154 is a precise, continuous reading level indicating system consisting of a probe detector, transmitter, and indicator. The probe condulet houses a miniaturized capacitance bridge circuit, energized by a regulated Hartley oscillator in the transmitter. In operation, the probe detects media level change as a change in capacitance, unbalancing the capacitance bridge. This out-of-balance condition is fed to the indicator via the transmitter as a DC signal proportional to the level change.

The new Level-Tel 154 is ruggedly designed for accurate operation. It may be used with nearly all liquids, slurries, powders and granular solids. Virtually insensitive to temperature and pressure extremes, the system functions reliably under difficult conditions, i.e., interface, mass measurement, corrosive materials, food processing, cryogenic liquids, combustible substances, and abrasives. It is available in either explosion proof or water tight housings. Let the modestly priced Level-Tel 154 start saving you money now! Write for Bulletin RF-5915 and the address of our nearest technical field representative.



HIGH ORDER LINEARITY

Unique dectector circuitry permits system linearity consistent with demanding process control requirements.

BUILT-IN TEST CIRCUITRY

Functional system checkout and calibration are simply accomplished by depressing a test circuit button on the control panel indicator.

SIMPLE MAINTENANCE

Printed circuit wiring and plug-in provision for critical components assure minimum maintenance time.

SET POINT CONTROL

High and low level indicator set points adjustable at control panel.

ENGINEERS I Dynamic growth offers expanding opportunities to qualified EE's and ME's. Send resume to R. A. Sweeney.

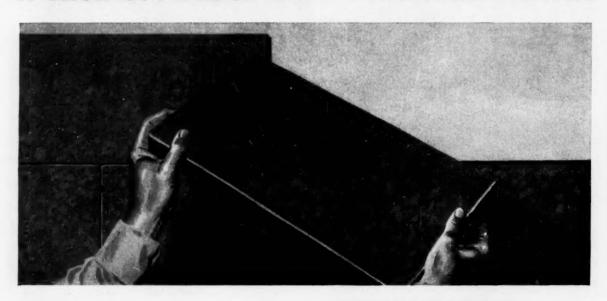


SANTA ANA FREEWAY AT EUCLID AVENUE ANAHEIM, GALIFORNIA

AERONAUTICAL AND INSTRUMENT DIVISION



A TRUE-CUT BLOCK WITH PRECISION-FINISH!



- Eagle-Picher's "precision-finish" is one of the most important insulation developments in years.
- Highly efficient, all-purpose block that is practically dustless.
- Great structural strength! Meets rigid demands for long-lasting block able to withstand wide temperature range up to 1900 F.
- Lightweight, easily installed! Easily cut to fit irregular areas—no special tools needed. Requires only minimum reinforcing.
- Effectively resists steam and other moisture! Does not disintegrate or lose thermal efficiency under heavy duty service.

EAGLE-PICHER

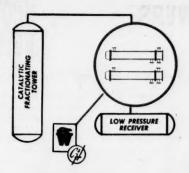
PV SUPERTEMP BLOCK INSULATION

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.



Since 1843
The EAGLE-PICHER Company
Dept. CE-1019
Cincinnati 1, Ohio

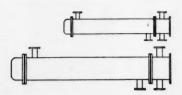




NEW "CAT" FRACTIONATOR OVERHEAD CONDENSERS TUBED WITH WOLVERINE TRUFIN® TYPE S/T CONDENSER TUBE



INCREASED EFFICIENCY—Trufin Type S/T is an extended surface tube with its fins an integral part of the tube wall. Because of this, Type S/T has more than two limes the heat transfer surface of prime surface tube—extracts more BTU's per foot of tube. Shown here are comparable lengths of tube for equivalent heat transfer surfaces.



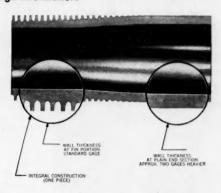
LOWER COST—Type S/T's additional outside surface area permits the use of less tube for a given heat duty. You get smaller shells, baffles, reduce fabricating costs with lower maintenance because there are less tubes to clean.



EASY INSTALLATION—Trufin Type S/T rolls into headers as easily as plain tube—uses the same fabrication methods. Standard rolling-in tools are used. There is no deviation from existing fabrication procedures.

Because of Wolverine Trufin Type S/T condenser tube, new standards of efficiency and economy are daily being established in the field of heat transfer. Diagramed above is another Trufin installation—this time the condensing, for a large Midwest refinery, of hydrocarbon overhead vapors from a catalytic cracking unit fractionating tower.

Illustrated here are four solid reasons why this company specified Trufin Type S/T for the job. Wolverine Trufin Type S/T will work exactly the same for you as it does for this company. Put it to the test—specify it next time you retube existing equipment or are contemplating the design of new units. Write today for your copy of the Process Flowsheet booklet—it's filled with helpful design information.



ENGINEERED FOR THE JOB—Trufin Type S/T is specifically designed for shell and tube applications. The cutaway photograph illustrates its unique, one-piece construction. Because of this, Type S/T gives constant efficiency—its fins are unaffected by thermal shock, vibration or varying pressures.

CALUMET & HECLA, INC.

LUMET & MECLA, INC. CALUMET DIVISION URANIUM DIVISION GOODMAN LUMBER DIVISION WOLVERINE TUBE DIVISION Comedo:

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UNFIRIT TUBE DIVISION
MANUfacturers of Quality Controlled Tubing and Extruded Aluminum

See Wolverine Tube at Booth 1111-27th Exposition of the Chemical Industries-Nov. 30 through Dec. 4, New York City.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES

TURBO-COMPRESSORS AND BLOWERS

2500 cfm and up

By Eugen P. Eicher, M.E., Brown Boveri Corp.

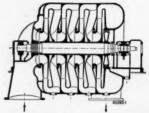


Brown Boveri offers complete compressor sets including compressor, choice of drives and all auxiliary equipment. Brown Boveri manufactures all the components, assembles and tests the complete sets in their own workshops and assumes full responsibility for the complete unit.

Compressors include a full range of centrifugal and axial types. Drives include steam turbines, gas turbines expander turbines and electric motors. (Where hot waste gases are available, for example, a combination of motorgenerator and exhaust-gas expander turbine drives has reduced power costs 60 to 70%.) Auxiliary equipment includes gear sets, pressure and volume regulators, air and gas coolers and complete electrical control systems.

Brown Boveri compressor sets are used by many leading U. S. companies and are backed by engineering skill, product reliability, and complete U. S. service staff and facilities.

2500 to 175,000 cfm at up to 60 psi* Uncooled centrifugal blowers



Four-stage centrifugal compressor.



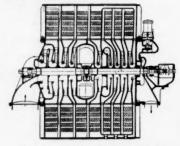
One of two 40,000 cfm centrifugal blowers with steam turbine drive in a copper conversion plant, Arizona.

First developed by Brown Boveri. Advantages over reciprocating compressors in the above ranges: lower cost, higher efficiency, less maintenance, less floor space and clean, oilfree air.

Standard designs are for air or non-poisonous, non-corrosive and nonexplosive gases. Stainless steel impellers, shafts, etc. are available for corrosive gases. High-pressure casings and oil type sealing glands are available for higher pressures.

Applications: Blast furnaces, converters, coke ovens, gas distribution, process air and gases, air separation plants, sewage aeration, tunnel ventilation.

5000 to 80,000 cfm at 60 to 120 psi* Internally-cooled "Isotherm" centrifugal compressors



Nine-stage "Isotherm" compressor with anti-surge power-recovery turbine.



"Isotherm" compressor driven by a synchronous motor (left) and a waste-gas recovery turbine (right) at a California chemical plant.

Highest inherent efficiency. Ten basic models with 6 to 9 stages per casing. Impeller diameters from approx. 1 ft. to 4 ft. The larger models include a built-in power-recovery turbine to allow running at loads below the surge limit.

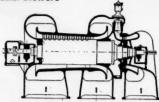
Stainless steel impellers, shafts, etc. are available. For discharge pressures higher than 120 psi, "Isotherm" compressors are followed by an uncooled centrifugal compressor or other booster.

Drives: Four-pole synchronous motors are generally preferred for

1500 hp and larger units, other type motors for smaller sizes. Speedincreasing gears are used with all motor drives. Variable-speed steam or gas turbines are direct coupled.

The reliability of "Isotherm" compressors is proved by hundreds of installations in mines, shipyards, chemical process plants, air liquefying plants, aerodynamics laboratories.

10,000 to 500,000 cfm at up to 80 psi* Axial blowers



Ten-stage axial compressor with anti-surge power recovery turbine.



Axial blower, steam turbine drive, supplying 70,000 cfm of air for a blast furnace.

Substantially more efficient than centrifugal units for large air volumes where adequate pressure can be delivered with a single unit and without cooling. The higher efficiency allows smaller and better drives and lower cost. A power-recovery turbine may be built in to permit operation at volumes below the surge limit.

Drives. Steam turbines allow simple, automatic control through Brown Boveri pressure-oil governors with pressure or volume regulator. Brown Boveri gas turbines and electric motor drives of all types are also available.

Applications: Gas turbines, wind tunnels and chemical plants. In Europe, Brown Boveri axial compressors driven by gas turbines are widely used for blast furnace air with substantial power savings.

*Capacities for single machines. Higher discharge pressures can be obtained by combining various types of equipment in series.

BROWN BOVERI

U. S. Sales and Engineering: Brown Boveri Corp., Dept CE-10, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities.

Why



Insul-Mastic

costs less

than ordinary asphalt coatings...

There are several ways to measure the cost of a protective coating. But the only true way is by measuring its performance. And performance is determined largely by the materials that go into a coating.

Insul-Mastic is sometimes considered an asphalttype coating. But, unlike ordinary asphalt coatings, Insul-Mastic contains special materials which resist corrosion and wear far longer and better than straight asphalt coatings.

These materials include:

 Large Amounts of Gilsonite—the natural resin that is virtually unaffected by moisture, acids and alkalis.

- Mica Flakes—highly resistant to weather, wear and sun's rays.
- Asbestos Fibers—used as binders to provide greater toughness and resistance to wear.

Obviously, Insul-Mastic costs a few cents more than common asphalt coatings. But, when you measure its cost in terms of far greater service life (10 to 20 years is not uncommon), Insul-Mastic always proves to be your most economical investment!

Still another important Insul-Mastic plus is the technical field service which is available whenever you need application assistance. Call your Pitt Chem Distributor for full information about Insul-Mastic coatings, today!

Think First of the Coatings that Last!

PITT CHEM "Insul-Mastic"® Gilsonite-Asphalt Coatings

PITT CHEM "Tarmastic" Coal Tar Coatings

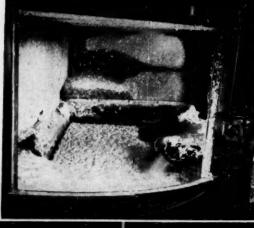
PITT CHEM "Tarset"[®] Coal Tar-Epoxy Resin Coatings

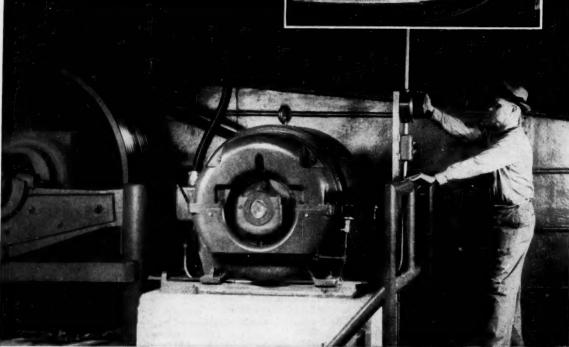
PITT CHEM Industrial Coatings are available through leading Industrial Distributors. See the "Yellow Pages."



PROTECTIVE COATINGS . COAL CHEMICALS . PLASTICIZERS . ACTIVATED CARBON . CEMENT . COKE . PIG IRON . FERROMANGANESE

HOW TO BEAT A TON OF PULP...







Alton Box Board Company is one of America's most complete paperboard and packaging organizations.

The manufacture of paperboard, basic component of folding cartons and corrugated and solid fibre containers, is a complex process requiring massive machinery driven by powerful motors.

This top liner finishing beater, for example, is a giant "mixer" that beats 2000 pound batches of kraft pulp, mixed white paper, clays and water to form a highly liquid pulp. It is driven by a Wagner

150 hp low speed splashproof motor. The endplates are built in two sections to provide ready accessibility to the sleeve bearings.

Whatever your motor requirements may be, Wagner can build a special motor, or provide a standard motor to fit your need. Wagner builds motors in ratings through 1000 hp, with a wide variety of enclosure types and mountings. Call your nearby Wagner field engineer for an engineering analysis of your next motor application. There are Wagner branches in 32 principal cities.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

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SERVING 2 GREAT GROWTH INDUSTRIES ... ELECTRICAL ... AUTOMOTIVE

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We got 'em -You can have 'em -They're FREE!

Years of experience in working with Hydrogen Peroxide have produced a wealth of information on this valuable compound, its properties, and reactions. Much of this information is available virtually exclusively from Becco. We've compiled a number of Technical Bulletins, which are yours free on request. Simply decide which ones you want, and mail the coupon below.

- No. 2-Hydrogen Peroxide (general information)
- No. 41 Becco H2O2 35% HP (high purity)
- No. 42 Becco H2O2 35% Formula D (for preparing dilute solutions)
- No. 46-Concentrated H2O2 (over 50% concentra-
- No. 70 Becco Hydrogen Peroxide SP"100" (Super Pure, of virtually 100% concentration.)



Where can you use these other Becco PEROXIDES?

By "other", we mean "Other than Hydrogen Peroxide". Lots of otherwise knowing people labor under the impression that Becco makes only H₂O₂. Actually, there are quite a few "other" useful peroxides in Becco's catalog, some of which are especially suited to high-temperature oxidation reactions

Look over the list below. Give you ideas? Remind you of a prob-lem you've got? Either way, a note to Becco will bring you more information. Or, use the handy coupon.

UREA PEROXIDE - for use in hair dyeing and cold waving, disinfectants, hypo eliminators, and as a source of water-free H2O2.

SODIUM CARBONATE PEROXIDEfor compounding detergents and adhesives.

SODIUM PERBORATE - for use in dyestuff development, detergents, tooth-powders; as a mild bleaching agent and cold wave neutralizer.

CALCIUM PEROXIDE - for dough conditioning and in high-temperature oxidation reactions.

MAGNESIUM PEROXIDE - an antifermentative, for compounding antacids and laxatives.

ZINC PEROXIDE - for use as a disinfectant and deodorant in dusting powders, ointments, etc.



Over 100,000,000 pounds of plasticizers have been made with **Becco proved-in-production** epoxidation processes, using Becco H,O,!

Practically everyone who manufactures plasticizers is using a Becco epoxidation technique or a slightly modified version.

Since 1950 Becco has been foremost in research and development of the epoxidation of unsaturated fatty acid esters.

Take advantage of these years of experience. Write immediately, outlining your particular interest, or request a free copy of Becco Bulletin No. 69-"Epoxidation and Hydroxylation with Becco Hydrogen Peroxide and Peracetic Acid". Use the handy coupon below.

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News from

National Carbon Company

Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N.Y. Sales Offices: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco. In Canada: Union Carbide Canada Limited, Toronto

National Carbon representatives expand your engineering force



J. M. BROWN SALES ENGINEER

After graduating from Purdue University with a B.S. in Chemical Engineering, Brown spent five years in the Cleveland Sales Engineering Department developing new products, equipment design, and performing field installation and maintenance work.

For the past five years, Jim has been working with the chemical industry as a field sales engineer on the application and use of carbon, graphite and "Karbate" impervious graphite products.

New Size Activated Carbon Pellets Available for Catalyst Support





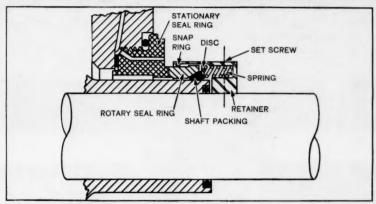
4/6 MESH

6/8 MESH

A new "Columbia" activated carbon grade CXC, which has been designated as a catalyst support, is now produced in smaller 6/8 mesh pellets.

The new size pellets have all the properties associated with the original 4/6 mesh size such as high activity, strong and uniform shape, high metal salt pickup, and low active ash. For details, contact National Carbon Company, 1300 Lakeside Avenue, Cleveland 14, Ohio.

"Karbate" Pumps with choice of Mechanical Seals assist Seal Standardization



"Karbate" pump seal arrangement with "John Crane" seal

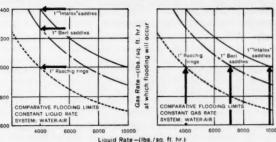
"Karbate" impervious graphite pumps Type C Model CA are available with either NATIONAL CARBON or "John Crane" mechanical seals. The "John Crane" seal arrangement is offered to partially meet the trend within chemical plants to standardize on one type of mechanical seal for rotary equipment.

NATIONAL CARBON'S design which has

proved satisfactory for many years is standard equipment on Model CA pumps. "John Crane" seals will be supplied as optional equipment.

"John Crane" seals can be installed on any "Karbate" impervious graphite pump Type C Model CA now in service by simply replacing the standard stationary and rotary seal components.

Carbon "Intalox" Saddles provide highest Efficiency and unmatched Corrosion Resistance



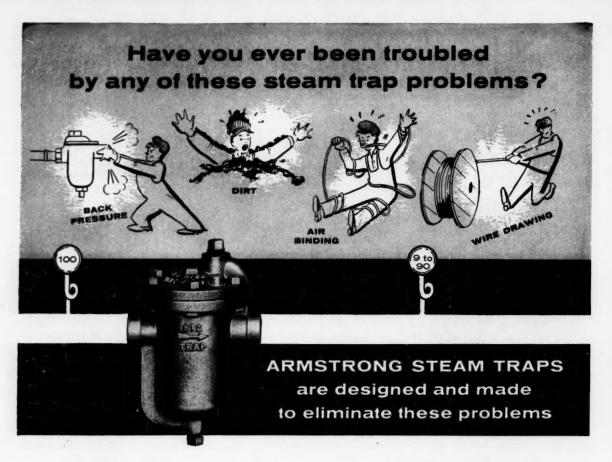
Carbon "Intalox" saddles, developed jointly by National Carbon Company and U.S. Stoneware Company, combine the operating efficiencies of the "Intalox" design with the almost universal corrosion resistance feature of carbon. These saddles can be used in stripping, absorbing, and scrubbing applications where hydrofluoric acid, hot alkalis, phosphoric acid, mixtures of hydrofluoric-sulfuric and hydrofluoric-phosphoric acids are present. Carbon saddles withstand abrupt temperature changes

ATIONAL TRADE-MARK without danger of cracking or spalling.

The above graphs show the higher efficiency of "Intalox" saddles as compared to Raschig rings and Berl saddles. The availability of carbon saddles permits the designing of smaller scrubbing, stripping and absorbing towers for highly corrosive applications. Also, capacity of existing towers can be increased by using carbon "Intalox" saddle packing. For details, contact National Carbon Company, P. O. Box 6087, Cleveland 1, Ohio.

"National", "Columbia", "N" and Shield Device, "Karbate" and "Union Carbide" are registered trademarks of Union Carbide Corporation





BACK PRESSURE ... Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

DIRT . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

AIR BINDING . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

WIRE DRAWING . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.





860 Series for low pressure heating service.



800 Series side inlet, side outlet



No. 801, side inlet, bottom outle



integral



200 Series, bottom inle



Forged Steel Series for high pressures,

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.



ARMSTRONG MACHINE WORKS

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Three Rivers, Michigan

See Our Catalog in Chemical Engineering Catalog



Bulletin 713 combination starter in Crouse-Hinds screw type enclosure for hazardous gas and hazardous dust locations. Screw type covers permit quick access to starter or circuit breaker.



Bradley quality motor control.

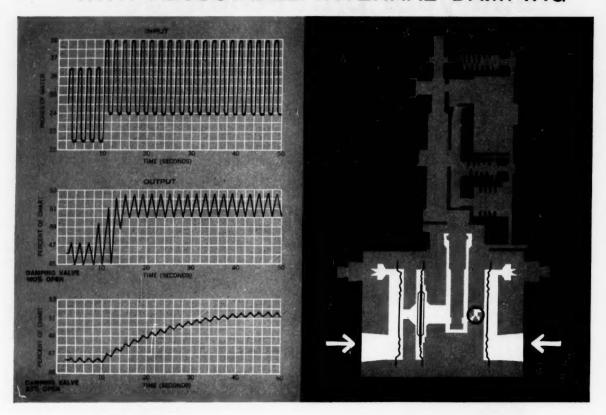
Allen-Bradley solenoid starters have the simplest contact mechanism yet devised—there is only one moving part. Such simplicity automatically assures millions of trouble free operations. The double break, silver alloy contacts-standard throughout the A-B line-never need servicing. In addition, the permanently accurate thermal overload relays give reliable protection against dangerous overloads, no matter what the atmospheric conditions or how long the overload relays have been in service.

Protect your production while protecting your plant . . . specify Allen-Bradley quality . . . it will do this job efficiently and reliably.

Ouality Motor Control

Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

NEW dp TRANSMITTER SOLVES FLOW PULSATION PROBLEMS WITH ADJUSTABLE INTERNAL DAMPING



Only Fischer & Porter dp Transmitters let you "tune in" exactly the right amount of damping action for the pipeline flow you're measuring. By eliminating the over-damping on some lines, underdamping on others resulting from fixed damping techniques, F & P gives you faster, more accurate response, longer instrument life.

In the unique F & P system, a needle valve restricts oil flow through the sealed, silicone-filled measuring chamber. Damping is accomplished on the input side—before the differential is sensed—thus the

transmitter responds only to *real* inputs. You eliminate external dashpots and snubbers . . . the major cause of zero shift and diaphragm fatigue . . . both of which mean high maintenance costs and premature replacement.

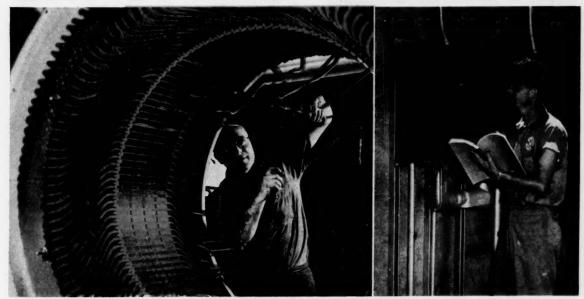
Write for complete information on how adjustable damping avoids control errors by matching the damping to the pulsation. Ask for your copy of Bulletin 91-251. Fischer & Porter Co., 209 County Line Road, Hatboro, Pennsylvania.



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The Current Revolution



Silicone Insulated Equipment Brings Economy, Flexibility

Chances are you've heard of the current revolution in electrical equipment . . . of outdoor motors stripped of weatherproof housings . . . of motors that laugh at overloads . . . of smaller, lightweight transformers that put power right where you want it.

These developments typify three phases of today's growing trend toward electrical equipment that's more reliable and easier to install . . . less expensive initially and in the long run.

Phase I — Self-Protecting Insulation Cuts Motor Costs

Motors need no costly enclosures . . . even outdoors . . . when they've got self-protecting insulation systems. The insulation system itself, when made with Silastic®, the Dow Corning silicone rubber, shrugs off weather, humidity, corrosion . . . is no longer the "weak-link" to be coddled. Result: There's no need for the elaborate enclosures that push motor prices out of sight. Open motors do the job — costs are cut as much as 50%! Proof: One firm saved \$28,000 on only three motors by specifying silicone insulated open motors rather than totally-enclosed fan-cooled units.

Phase II — Increased Service Factor Motors Reduce Power Costs

Motors with insulation systems that don't get "burned-up" when asked to carry overloads . . . that's one way of describing motors built with Dow Corning Silicones for extra service factor. When the going gets rough and production schedules are critical, they carry overloads of twenty-five to fifty percent beyond nominal rating . . . without distressing smoke

signals. And though they deliver more horsepower when needed, they're still no bigger than their conventional counterparts . . . have the same nameplate horsepower rating. Result: You specify motors to match load, let silicones carry the overloads. No need for larger, more expensive motors just to handle occasional overloads . . . and you gain in reliability, too.

Phase III — Silicone Insulated Transformers Give Power Where You Want It . . . At Less Expense

New dry-type transformers insulated with silicones contain no toxic or flammable liquids. They're smaller, lighter . . . don't require expensive vaults or barriers. Result: Silicone insulated transformers are easier to handle, easier to install, can be located right at load or load center, need almost no maintenance. They save on costly low-voltage cable, too. You get greater flexibility of the distribution system and cut costs at the same time.

KEEP PACE WITH THE BIG CHANGE

Send today for the booklet, "Specify Silicone Insulated Motors and Transformers and Save", and get the full story on the current revolution in electrical equipment. Address Dept. 2622.

SPECIFY Dow Corning Silicones and SAVEI



Dow Corning CORPORATION

MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

new Dracco Glass-Bag Filters EXHAUST MANIFOLD OUTLET AIR FLOW TO STACK FILTER COMPARTMENTS W/GLASS CLOTH BAGS & SPECIAL CLEANING MECHANISMS REVERSE AIR FAN TROUGH-TYPE HOPPER WITH INTEGRAL SCREW CONVEYOR INLET MANIFOLD INLET AIR FLOW NOW-the answer to your hot dust problem-

cloth filtration to 600° F. with safe bag cleaning by sonics

Radical design innovations including dust removal by "sound" now make Dracco Glass-Bag Filters a vital new weapon in industry's fight against hot, corrosive dust and fumes.

Safe, fracture-proof methods of cleaning glass cloth bags extend the high collection efficiencies, small operating costs and low maintenance of cloth filtration to the 600° F. temperature range.

This makes Dracco Glass-Bag Filters your best choice for the toughest industrial applications:

cement kilns • reverberatory furnaces • calciners • converters blast furnaces • cupolas • corrosive chemical processes carbon black production • steam micronizers

For detailed information on how Glass-Bag Filtration can hetp you beat that hot dust problem, contact a Dracco engineer now. Or write:

EXCLUSIVE DUST REMOVAL TECHNIQUES ASSURE LONGEST BAG LIFE

Sonoclean - patented cleaning by sonics low-frequency vibrations transmitted to bags at safe energy levels ... no deflection, creasing or fatigue . . no bag wear . . . no personnel hazard.

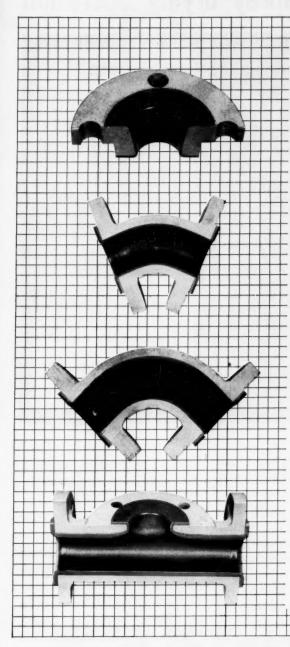
Reverse Air Flow — relaxation of bags accomplished by isolating filter compartment from main collector fan with control valves . . . low-velocity fan provides reverse air to collapse bags . . . results in effective cleaning without wear . . . no shaking required.

Swing-Clean - patented cam action imparts gentle downward wave or oscillating motion to bag . . . removes dust without fracturing glass cloth.

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STREAMLINED—Smooth contours and seamless liner of Fluoroflex-T in all fittings mean a minimum of turbulence and back pressure.

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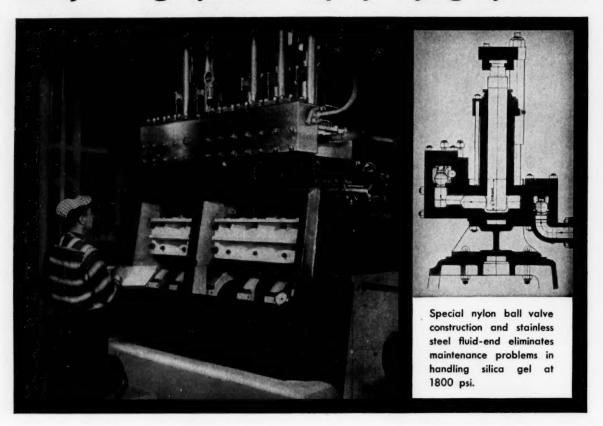




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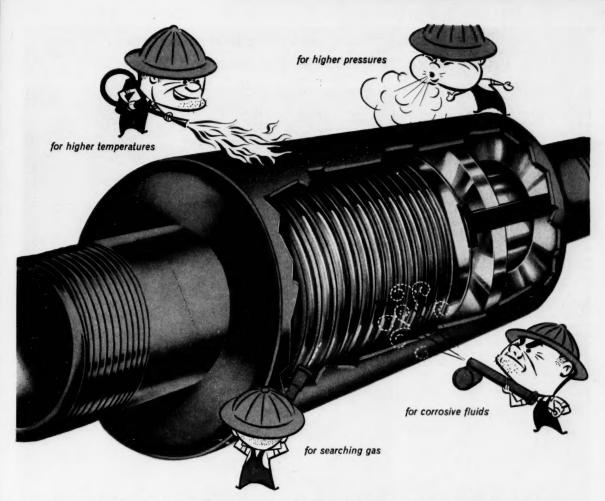
When Davison Chemical Ltd. built its new plant in Valleyfield, Quebec, for the production of petroleum catalysts, a major problem was to find a pump that (1) had the abrasion and corrosion resistance to stand up in a continuous high pressure process without downtime or excessive maintenance and (2) could maintain the steady pumping pressures necessary to control particle size, density and porosity of the spray dried product.

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The plant that never shuts down can't take a chance on Steam Traps

by John W. Ritter, Test Engineer SARCO Company, Inc.

It pays to take a careful look at the economics of the whole problem of steam trapping. This is particularly true where a plant is operating continuously.

a plant is operating continuously.

Twenty-four hour, 7-day production can be a mixed blessing. There is a great satisfaction in working to full capacity, but it doesn't leave much time to keep the equipment in first class working order. If major repairs or replacements become necessary, the partial shut-down that results can disorganize the whole output schedule.

Some steam traps are much easier to maintain than others, and it pays to look into this easy maintenance feature of traps as carefully as you examine their operat-

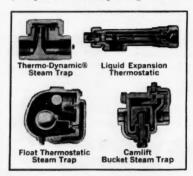
ing characteristics.

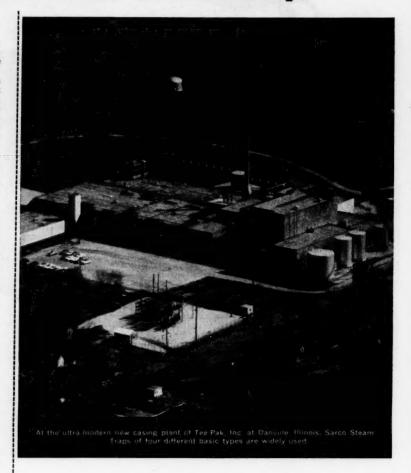
Another important point in steam trap selection is to be sure the right trap is chosen for each job. Plant engineers know the operating conditions and if new questions arise on which they want supplemental consultation, they can have their questions answered without cost or obligation by a group of men who have real depth and breadth of experience in production planned steam trapping — Sarco engineers. Sarco advice is always impartial advice, because Sarco makes all five types of steam traps.

Sarco engineers, for example, can demonstrate the economy of the Sarco TD-50, which is as near maintenance-free as a steam trap can be. They can show the special values of the Sarco Thermostatic, which requires no adjustment over a 300 psi operating range. There are any number of uses for the continuous discharge of the Sarco Float-Thermostatic particularly when closely controlled temperature

must be maintained.

For every steam trapping need there is one best steam trap, ideal in its operating functions and built for an absolute minimum of required service and maintenance. Studying your individual plant needs in steam trapping, and filling these needs with the traps best suited to do their respective jobs will pay out handsomely in your production and operating records.





At Tee-Pak's new casing plant they depend on SARCO Steam Traps to help prevent down-time

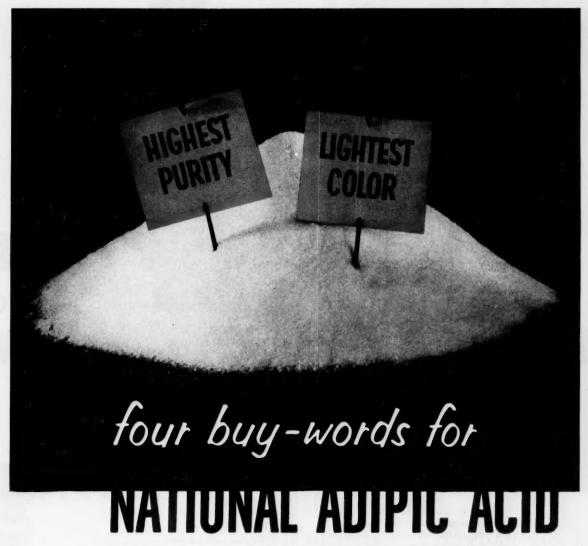
Twenty-four hours a day—seven days a week. That's the operating schedule at the modern new Danville, Illinois, plant where Tee-Pak produces its cellulose casings. Requiring dependable operation from all equipment, the company has used four different types of Sarco Steam Traps, each selected to do a reliable, trouble-free job in its particular application.

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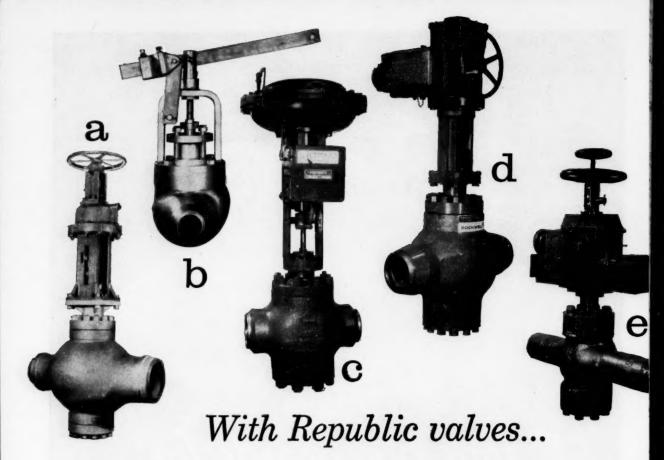
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Superior valve design-Republic research into the causes of valve noise and vibration, and also the wear resisting and galling properties of materials has resulted in a modern line of Republic valves of advanced design. Republic valve contours are designed to produce not only the desired regulating characteristics but also to reduce erosion damage and noise as well. Extra large guide bushings, extra deep stuffing boxes, solid plug inner valve construction, plus precise manufacture and long-life materials make Republic regulating valves perform better, last longer, with less maintenance.

Wide selection of valves and features—Rockwell-built Republic regulating valves shown on this page are representative of the complete Republic line:

- a. Cylinder operated valve
- b. Lever operated valve
- C. Diaphragm operated valve
- d. Motor operated valve
- e. Toggle head operated valve
- f. Diaphragm operated angle valve

And, for many special applications, such Republic accessories as pneumatic and electric valve positioners for hysteresis-free control, and a complete line of controllers are available.

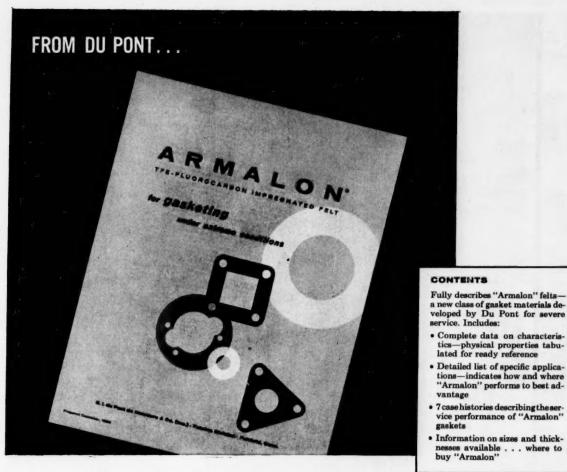
Whatever your regulating valve problem, let Republic engineers put their years of application experience to work for you. For additional information, see your Republic representative, or write to Republic Flow Meters Company, 2240 Diversey Parkway, Chicago 47, Illinois.

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*"Armalon" is Du Pont's registered trademark for its TFE-fluorocarbon resin impregnated felts. **"Armalon" TFE-fluorocarbon impregnated felt is covered by U. S. Patent 2,764,506.

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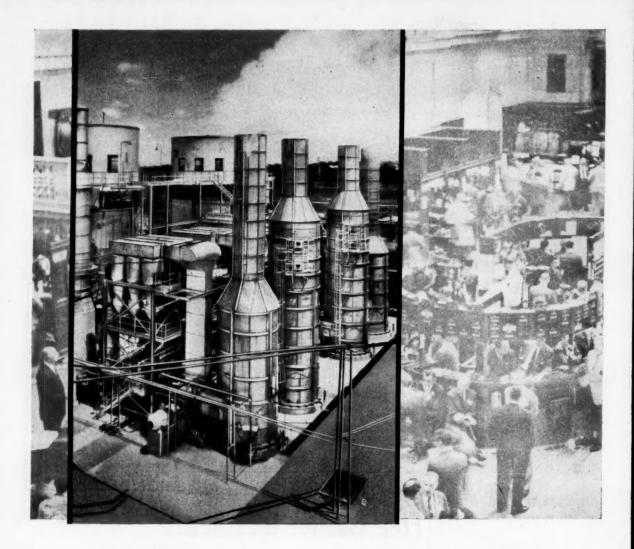


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American Cyanamid gets plant on time, within estimate through Pritchard's GOOD FINANCIAL DESIGN

Modern facilities like this new catalyst plant at Fort Worth, Texas have helped make American Cyanamid a foremost producer of industrial chemicals. The plant, which started with Cyanamid's development of a more efficient way to make a catalytic cracking catalyst, is a superb example of how client-contractor team-work can pay off. Cyanamid furnished the process; Pritchard supplied the plant design and construction service. By emphasizing the financial aspects of plant design while conforming to technical requirements, Pritchard engineers were able to make important savings on material and construction costs. As a result, the plant was completed below cost estimates and will make a better return on investment than originally anticipated.

Next time new facilities are being planned, put Pritchard on your team. In addition to topflight engineering and years of construction know-how, you'll get the services of a company that can bring a business viewpoint to the planning table. Good financial design is your objective — Pritchard can best help you get it. Pritchard's experience, gained in serving companies such as American Cyanamid, Allied Chemical, Dow, Frontier, Liquid Carbonic, Pure Carbonic, Monsanto and Spencer Chemical, is at your service.



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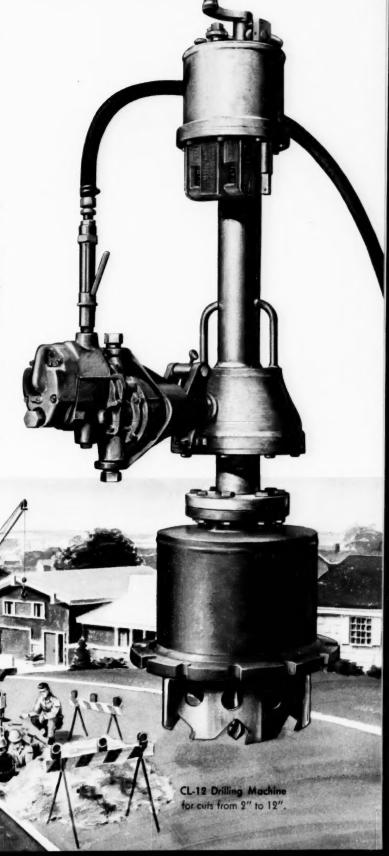
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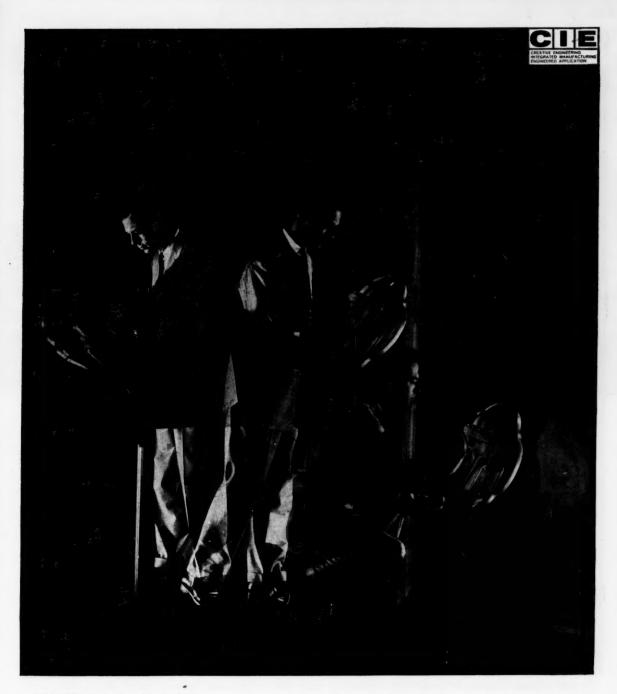
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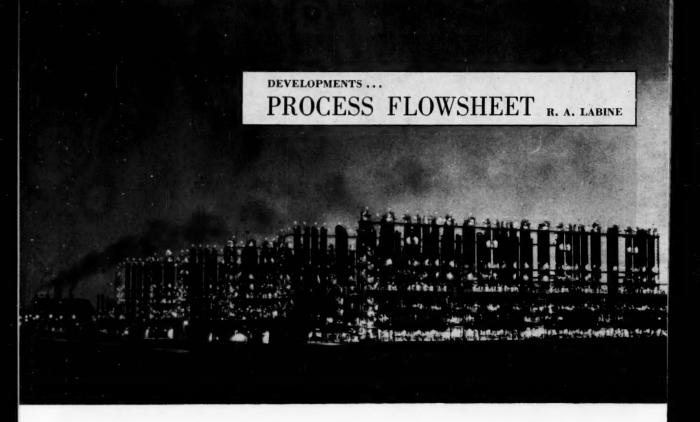
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For help in solving your pumping problem, write to: Goulds Pumps Inc., Dept CE-109, Seneca Falls, N. Y.





Secrets of Low-Cost Heavy Water

An intricate system of interstage flow and heat exchange makes the dual-temperature exchange process commercially feasible.

With the granting of U. S. Patent 2,895,803 in July, the public learned at last the secrets of Jerome Spevack's improved dual-temperature exchange process for making heavy water (*Chem. Eng.*, Aug. 10, 1959, p. 51). This process, in operation at the Savannah River, S. C., plant of the AEC* for seven years, has saved hundreds of millions of dollars over the previous water distillation process.

Major part of the cost of recovering deuterium from natural water (1 part D_2O to 7,000 parts H_2O) is the steam and cooling water needed to heat and cool the tremendous volumes of fluid

passing between the hot and cold towers.† Spevack's patented methods of interstage flow and heat interchange effect large utility economies and have pared the operating cost of the process down to \$13.50/lb. D_2O . (AEC's selling price of \$28/lb. includes depreciation of plant investment.)

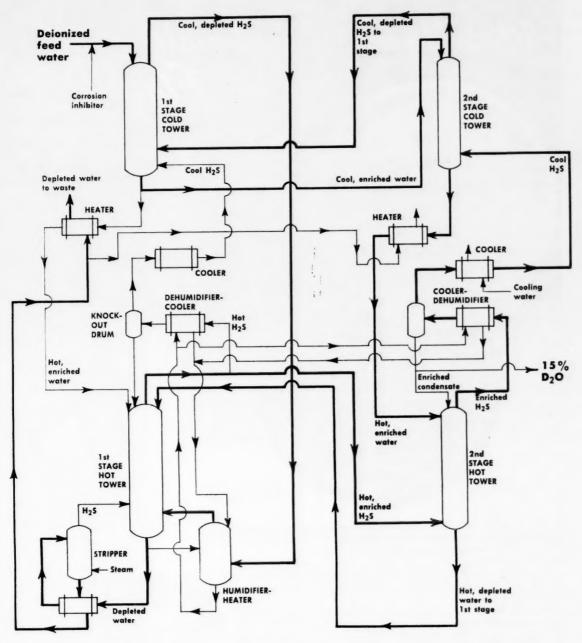
Inventor Spevack claims his process is more economical than competing processes including hydrogen distillation (*Chem. Eng.*, Feb. 23, 1959, pp. 68-72). Armed with his patent, Spevack is setting out to produce heavy water commercially, either in his own projected \$10-million plant or by licensing other companies. His projected market

■ Unfold Flowsheet |



A similar plant at Dana, Ind., was shut down in 1957 and is now being converted for other purposes by the Army Chemical Corps.

 $[\]dagger$ 40,000 tons of water enter the process and 150,000 tons of hydrogen sulfide are recirculated for every ton of heavy water produced.

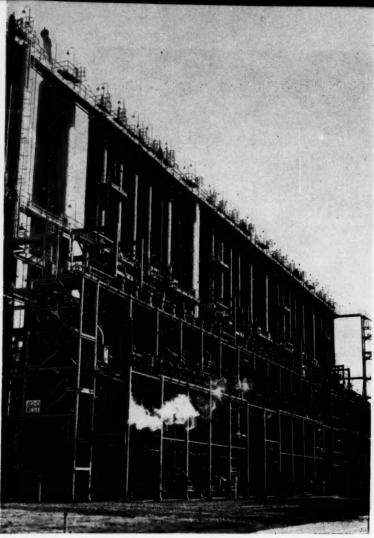


figures show a free-world demand of 1,160 tons/yr. for reactor moderation by 1965, with demand jumping to 8,000-11,500 tons/yr. by 1975, the latter figure assuming controlled nuclear fusion becomes a reality. (In contrast, the huge Savannah River plant's capacity is only 450 tons/yr.)

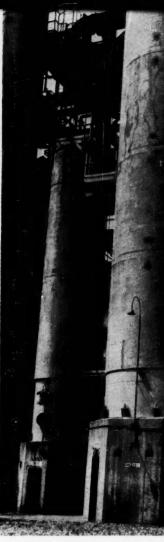
- ► Three-Way Savings—Three heat-saving innovations improve the older dual-temperature process covered in Spevack's patent no. 2,787,526.
- 1. Interstage flow of H₂S and water: Flows of both hot and cold H₂S and water between stages minimize heating and cooling requirements. Each succeeding stage (which handles only one-fourth

the fluid flowing a cold water feed preceding cold to H₂S from the firs hot tower, elim humidifying the

- 2. Direct-indir heat and humidit tower, H₂S contabubble-cap columbottom then flow where it cools at gas coming from to the top of the energy-recovery
- 3. H₂S stripping of the hot tower



BANK OF COLUMNS contains several individual D₂O plants consisting of two 15-ft.-dia. first stage towers and two 7.5-ft.-dia. towers in the second stage.



HUMIDIFIER section consists of bomarked by the entrance and exit due

e fluid flowing in the preceding stage) receives cold water feed supply from the bottom of the eceding cold tower. Similarly, some of the hot S from the first hot tower feeds the next stage t tower, eliminating need for heating and midifying the gas in all the successive stages.

2. Direct-indirect humidification cycle: To preat and humidify the cold gas flowing to the hot wer, H₂S contacts hot water directly in a 15-ft. bble-cap column. Cool water from column ttom then flows to a shell-and-tube exchanger here it cools and dehumidifies the hot enriched s coming from the hot tower and then returns the top of the humidifier, completing the closed ergy-recovery cycle.

3. H₂S stripping: Depleted water from bottom the hot tower contains H₂S which would create

pollution problems and add to operating costs if discarded. By steam-stripping in a 6-ft. packed column at about 400 F., H_2S content is sliced to less than 1 ppm. and heat value of steam outflow is utilized to maintain hot tower temperature while the bottoms serve to heat the depleted water.

▶ Process Principle—In the hot tower (about 250 F.) deuterium concentrates in the gas stream as HDS and D₂S. In the cold tower (about 85 F.) deuterium passes into water phase as HDO and

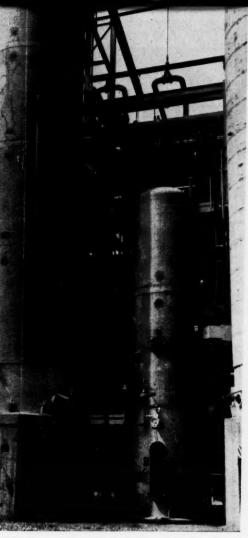
What It Takes to Make 1 lb. of D₂O

Feed water				 							 	40,000 lb.
Steam (250	psig.)			 				٠				6,000 lb.
Cooling wat	er (85	F.).	 								1,500 gal.

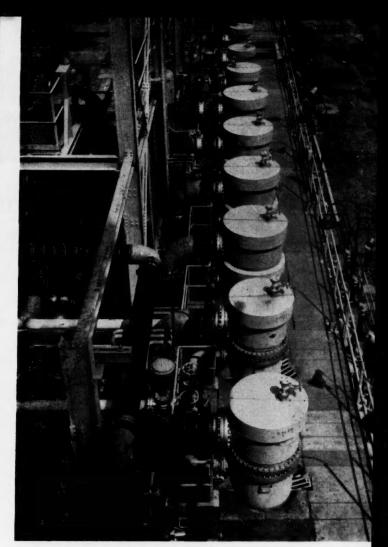
D₂O. Mu at the o tinuation

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D₂O. The
tional water fe

Two-st River de \$100 mi



of bottom ten trays in the large hot tower (middle) t ducts. The H₂S stripper is short tower on the left.



DEMONIDIRIERS, ordinary shell-and-tube exchangers, cool gas from hot tower against cold water from humidifier section.

Multiple stages (two at Savannah River, five he old Dana plant) are merely partial conations of the first stage.

roduct from final stage contains around 15% This is concentrated to over 90% by fracal water distillation followed by electrolysis h produces 99.8% D₂O.

uipment Setup—First-stage bubble-cap towers avannah River are 100 ft. high and 15 ft. dia. Ind-stage towers are only a quarter of the area use of smaller fluid flow. Towers are fabricated mild steel lined with stainless; amine or onia inhibitors have also been added to the refeed to retard corrosion.

vo-stage system was picked for Savannah r despite the higher cost (\$164 million vs. million for five-stage Dana plant) because design engineers feared that intricate interflow of both process streams would make D_2O production a direct function of accurate flow control. (Use of only two stages minimizes the number of control points.) In actual operation, however, process has proved relatively insensitive to normal flow variations.

Typical Plant Operating Conditions

Pressure	225 psig.
Hot tower temperature	250 F.
Cold tower temperature	85 F.
Mole ratio (H ₂ S:H ₂ O)	2:1
Deuterium in feed water	0.014%
Deuterium in product	15%
Liquid flow rate in 1st stage	8,500 gpm.



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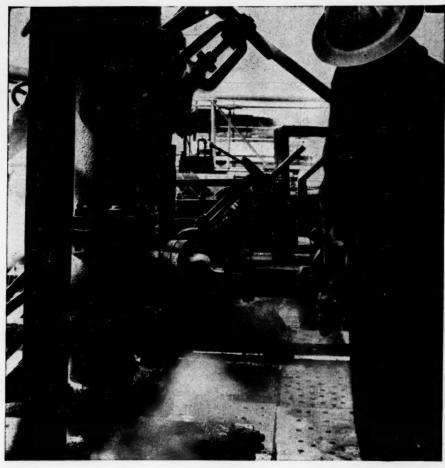
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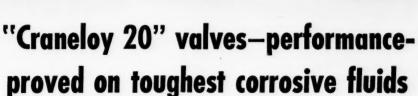
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The "Craneloy 20" gate pictured above controls highly corrosive, hot sulphuric acid sludge at a large Western refinery. While other valves in this service had to be replaced every 3 to 6 months, this Crane valve lasted a full 14 months before requiring minor repairs.

All parts in contact with the flow are "Craneloy 20"—a high-nickel, high-chromium stainless alloy—poured in Crane's own foundries.

Crane alloy valves (either "Craneloy 20" or Type 316 stainless) give you an extra measure of value. Unique design of the split-wedge disc provides uniform pressure all around the seating surface... eliminates need for high seating forces. Free-to-rotate discs minimize seating wear and prevent galling.

For details of other features and applications of Crane alloy valves, see your Crane Representative.



"Craneloy 20"—No. 20045 gate valve. ½" to 12"; 150 psi at 500 F; 230 psi at 100 F.



Crane split-wedge disc design. Free-to-rotate discs employ special guides to prevent rubbing against seat during operation.



Get full facts on "Craneloy 20" and other Crane quality alloy valves. Ask your Crane Representative for Circular AD-2080 or write to the address given below.

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RAYMOND IMP MILL with Flash Drying Accessories. For further details, write for Raymond Bulletin No. 85.

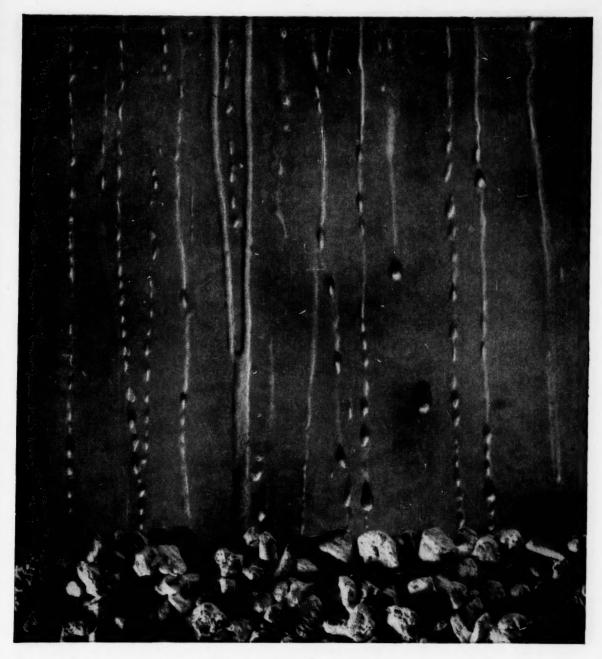
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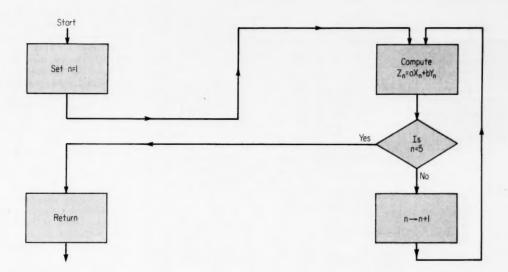
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For easier computer programming . . .

Flowsheet Your Calculations

Standard methods and nomenclature can also assist in clarifying complex computations to be solved by slide rule or hand calculator.

LEONARD M. NAPTHALI, Assoc. Prof., Chem. Eng., Polytechnic Institute of Brooklyn, N. Y.

ELECTRONIC digital computers are a fact of life in most engineering today. If your company does not have one, it is probably considering the acquisition.

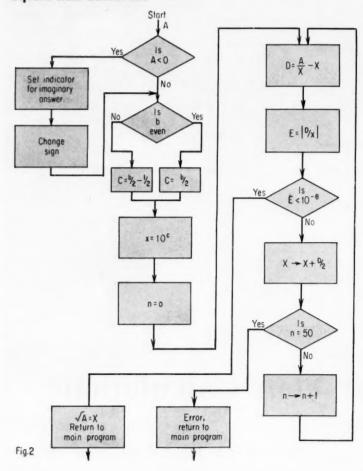
Computers are making it possible for you to use more powerful tools in engineering design and research. Long useful for business and routine engineering calculations, they are now moving in on the production man through Operations Research and computer control systems.

It is not necessary for every engineer to become a computer programmer (although this is becoming increasingly easy with recent developments in automatic program compiling). However, it is useful for every engineer to adapt some of his ways of thinking to this ever-present machine. Basically, a digital computer is a collection of electronic switches, controlled by holes in cards or tape, or by magnetic pulses, or by other switches. (See *Chem. Eng.*, Sept. 7, 1959, pp. 127-144.) Using analogies between switching rules and the rules of logic, the computers have been developed to the point where they do elementary arithmetic, as well as store numbers in coded form.

These machines also store codes of switch settings (or "instructions") in the same memory unit. The "instructions" are executed in a specified sequence, which may be varied by "decision" or "logical" operations. This sequence of instructions is called the "program."

The result is still a mechanical device with no intelligence whatever in the usual sense. It is human ingenuity, foreseeing a wide range

Square Root Subroutine



of possible contingencies and coding machine behavior into a program, that gives the computers their appearance of intelligence.

Computers now not only play poker and chess, but are quite efficient at programming machines. But even though a machine can detect errors in human instructions, it can do only what it was programmed to do. It cannot exercise any judgment except what the programmer put in. It cannot guess, except by a precisely prescribed guessing procedure.

Planning exactly what is to be done is the first step in the preparation of a calculation for a computer. A very useful technique for communicating and recording the "plan" of the computation is the flowsheet, which is analogous to a process flowsheet.

A good computer flowsheet is essentially similar to a set of instructions such as you might leave to a nonprofessional assistant to complete calculations in your absence. (You may be physically present at the time of computation, but it is wasteful to have the machine wait for your judgment on what to do next.) Because of the nature of the computer, the flowsheet must be complete.

Obviously, the flowsheet, as a method of describing and planning computations, is of much wider use than simply in planning for a computer. When a calculation is to be done repetitively, whether manually or by machine, it is worth

while to make it as efficient as possible.

Basic Ideas

At the outset let us distinguish between two different kinds of activity in a calculation. The first is arithmetic (which may be performed by the desk calculator as well as the electronic computer—the main difference being in speed). The second is called "logical" activity (supplied by humans in hand computation), which is deciding what to do next, and which numbers to do it to.

Arithmetic operations consist of the usual set of functions performed on a desk calculator: addition, subtraction, multiplication, and division. While electronic computers can perform some other operations, such as those of Boolean algebra, it is sufficient for our purposes to stick to ordinary arithmetic operations.

Logical operations are decisions to follow one or another path of action, the path to be followed being prescribed by the facts at hand. In slide-rule or calculator computations, the operator makes the decision. In computer computations, the programmer makes the decisions and programs them into the machine so that the machine will do the right thing at the right time.

Terminology and Conventions

There are no universally accepted conventions for calculation flowsheets. The following rules are suggested to help standardize them:

• The lines on a flowsheet are used to indicate the order in which steps are taken, or flow of "control." They do not imply flow of information, as we assume that all the numbers we are interested in are always available.

 The rectangular boxes indicate arithmetic steps. There is one input and one output from each.

• Diamond-shaped boxes represent branches on which exit can be made in more than one way. These are the "decision" or "logic" boxes.

• The symbol \rightarrow is occasionally used (as in $n \rightarrow n+1$) to indicate computation of a new value of a variable using the old value. It may be read as "becomes," i.e., n becomes the old n plus one.

• The sequence of boxes may be placed so that the flowsheet is read from left to right or from top to bottom. The top to bottom arrangement is recommended, because it clearly defines separate columns.

• A loop is set in a column to the right of the main flow in which it occurs. Thus, a loop within a loop is set still further to the right and so on.

If this convention is followed, the boxes farthest to the right are executed the most often, and must be most carefully planned for economy in computation.

Other Definitions

Branches—In the construction of the detailed diagram for the square root calculation, Fig. 2, it should be noted that the details could have been spelled out still more closely, but the important boxes would still be the ones shown as diamond shaped.

In these boxes the flow of control is determined by some sort of a test ("logical operation") to determine whether a number is negative, zero or positive. By combining these tests with arithmetic operations, we can determine whether one number is less than, equal to or greater than a second.

Branches can be constructed with an arbitrary number of forks, and the choice of branch can be made on any criterion which can be reduced to a comparison of numbers.

Loops—The branching operation is used to construct loops; i.e., sequences of instructions which are repeated in substantially unchanged form.

A loop can be executed a fixed number of times, by counting the number of times executed, say until n=50, or the loop can be executed repeatedly until some criterion is satisfied, such as $|A/X^a-1|<10^{-a}$. Thus it is possible to use the same instructions over and over again in a trial-and-error calculation until certain numbers check to a prescribed precision.

Or the same instructions can be used repeatedly in order to perform operations on arrays of numbers like solving a material balance equation repeatedly for a series of compounds. The flowsheet on p. 179 is an example of this, where $Zn = ax_n + by_n$, x_n and y_n are known, and we wish to evaluate Z_n for n = 1 to 5

Subroutines — Certain standard operations may be used repeatedly

in the same program in different places and, in fact, even in different programs by different people. For example, standard mathematical operations, such as numerical integration and interpolation, are often required. Logarithmic, exponential and trigonometric functions are also commonly needed. From the need to avoid repetition of instructions whenever any of these are required, the concept of the subroutine developed.

Any set of instructions can be so arranged that it can be called upon at will to perform specified operations on data and then return control to the original program. For example, if a square-root routine is located in the program as a subroutine, it is called upon whenever a square root is needed. The programmer then need never write a square-root program.

Once a subroutine has been written for a particular machine, it usually becomes available from a program library so that the work need not be done again. The subroutine may be used as a building block in still more complex operations. Thus, programs are constructed in a manner analogous to

the modular construction of electronic equipment. It is only necessary to know the external characteristics of the "black box" to use it.

Constructing the Flowsheet

Flowsheets may be constructed in varying degrees of detail, as needed in different stages of development of the program. For example, take the square root of a number, A—given in the form $a \times 10^{\circ}$, where $0.1 \le a \le 1.0$ —by the iteration formula $X_{n+1} = \frac{1}{2} (X_n + A/X_n)$. This can be shown by either of the flowsheets illustrated in Fig. 1, below, or Fig. 2.

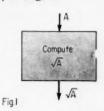
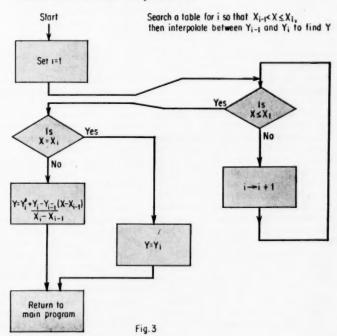
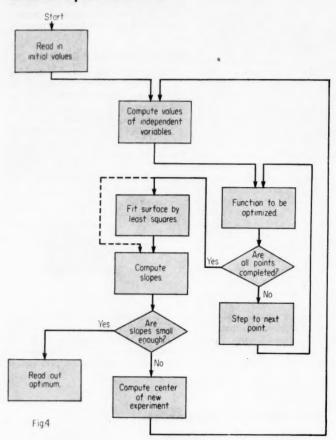


Fig. 1 could be considered as the "black box," the subroutine whose external characteristics only are needed for its use. It is simply an instruction that can be carried out

Table Search and Interpolation



General Optimization Scheme



by the computer which has already "learned" how to extract square roots. It is equally applicable to humans who also know how to extract square roots.

Fig. 2, on the other hand, can be considered the circuitry of the "black box." It shows in detail the steps that the machine must go through to extract the square root of a number. Included are all points where logical operations must be performed and the criteria on which the operations are based. A similar flowsheet would be useful for instructing a human in the procedure for extracting square roots.

As mentioned previously, Fig. 2 could have been shown in still greater detail by amplifying the reasons for and the results of each step. However, it is sufficiently clear for its purpose in its present form. The programmer knows the reasons why, the machine doesn't

want to know, it has no curiosity.

Fig. 3 illustrates a table search and interpolation. It also illustrates the principle of economizing where an operation must be repeated many times. A table search can be a tedious and prolonged operation requiring the performance of the same procedure over and over again. This part of the problem, therefore, is set to the right hand side of the flowsheet and reduced to its simplest terms.

An interpolation, on the other hand, once X is found, is a once-only operation, so it is set to the left side of the flowsheet and little attempt is made at economizing.

The general optimization scheme shown in Fig. 4 is a flexible flow-sheet directly applicable to a continuous-flow chemical process. As shown, of course, it is greatly simplified since each box of the flow-sheet could be expanded into a great

many individual computations, depending on the function to be optimized and the store of relevant subroutines already in the machine or available for inserting in the program.

The "function to be optimized" may be the operating profit of an actual plant, computed from the outputs of plant instruments. Inputs to the box are the set points of plant controllers. In a sense, the plant itself is a part of the computer program, or from another point of view, the computer is operating the plant. The "read out optimum" box is eliminated and the computer program is permanently tied in a loop, continuously testing the plant and readjusting it.

Fig. 4 could illustrate a plantdesign economic study which produces a predicted profit as its output.

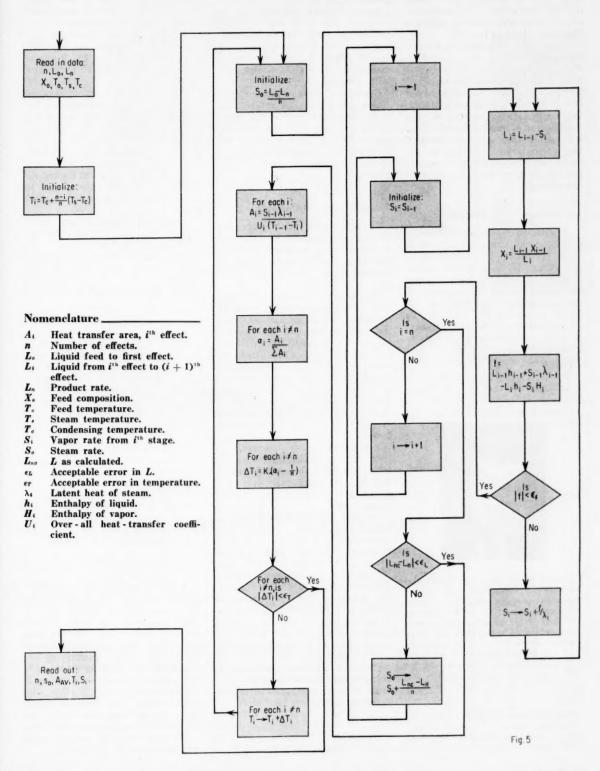
In another application, the input to the flowsheet could be a set of experimental data for independent and dependent variables. A calculation scheme leads from the independent to the dependent variables but involves a set of adjustable parameters that are to be adjusted to produce the best fit between calculated and experimental values of the dependent variables. The function to be optimized is the sum of the squares of the deviations.

The "calculation scheme" is not restricted to algebraic functions, but can be any scheme of which the computer is capable—a differential equation, for example. It can be used for fitting a mathematical model to the plant behavior. Then the optimization experiments for the computer-controlled chemical plant can be performed on the mathematical model. An interesting possibility is the fitting of a mathematical model to economic behavior, for market forecasting or conceivably for predicting the stock market.

A complete flowsheet for a forward-feed multiple-effect evaporator is shown in Fig. 5. We are given data for n, L_o , L_a , X_o , T_o , T_o , and T_c . We wish to determine the optimum n, S_o , A_{AV} , T_i and S_i from the available data.

The given independent variables are inserted in the first box of the flowsheet. Additional boxes, as many as needed, containing the proper mathematical expressions for the relationships between the dependent and independent vari-

Forward Feed Multiple-Effect Evaporator Computation Flowsheet



ables are then inserted in the flowsheet in the correct sequence. These show that at the indicated places in the flowsheet, the computer should be programmed to perform the calculations in the box.

At certain points in the flowsheet, logical operations are inserted to test the progress of the computation. The criteria for the tests are written in the diamond-shaped boxes. If the criteria are satisfied, the computation proceeds to the next series of mathematical calculations. If they are not satisfied, the computation returns to the series just completed and repeats the calculations until the criteria are satisfied.

Limitations of a Flowsheet

A flowsheet does not help the computer, or the nontechnical human, to do its job. It is constructed by the programmer in terms intelligible to the programmer to assist him in laying out the sequence of operations that the computer will follow in solving the problem. To be of practical use, the flowsheet must be re-expressed in terms intelligible to the entity actually performing the computations.



LEONARD M. NAPTHALI is keenly interested in computers and higher mathematics. Dr. Napthali teaches chemical engineering mathematics at Brooklyn Polytech where he is associate professor in the Chemical Engineering Department. Previously, he was a research engineer at Ford Motor Co.'s scientific lab. He received his BS from Cooper Union and his doctorate from the University of Michigan in 1953.

Dr. Napthali was co-author of "New Statistical Method Rapidly Determines Optimum Process Conditions" which appeared in the June, 1957, issue of CE.

A raw flowsheet can be of considerable help to an engineer who intends to do the work himself on a hand calculator or slide rule. In this case, the flowsheet is a well laid out plan of attack on the problem, designed for maximum economy of effort. Such a flowsheet is completely intelligible to its user in its original form.

Computers, however, cannot read a raw flowsheet. The information on the flowsheet must be translated into a language that the computer can understand and given to the computer in a digestible form. In short, the computer must be programmed.

Programming a Computer

"Programming" as commonly used often designates the entire job of preparing a computation for a computer. In this sense, preparing a flowsheet is a major part of the job.

Specifically, however, a computer program is usually a set of machine instructions such as "clear the register and add the contents of memory location 100. Add the contents of location 200. Store the result in 300." These instructions eventually wind up in the computer as codes located in the memory bank. They are usually written as an alphabetic code, following a plan such as that described by a detailed flowsheet.

Sometimes great ingenuity is used in rapidly accomplishing the tasks set forth by the flowsheet, but for the most part writing a program or "code" is a tedious clerical job.

A most promising technique is the development of automatic program compiling techniques such as "Fortran" for the IBM 704 and "Fortransit" for the IBM 650. Here the engineer does his own programming with the aid of the machine. He expresses the calculations he wishes to perform in a notation resembling that of algebra. This is punched into cards and loaded into the machine with a special program, which interprets the cards and writes a machine program to achieve the desired results.

In Fortran, computation is indicated by statements such as: Y = 2.*X + 3. + B

$$Y = (-B + SQRTF (B**2 - 4.*A*C))/(2.*A)$$

where square root is indicated by SQRTF(), multiplication by *, exponents by ** and + and - by the usual signs. This is interpreted to mean that the right side is computed and the result becomes the value of the variable on the left. Thus a statement I=I+1 means add 1 to I, and the result is the new value of I.

Other important statements in the vocabulary are the transfer, for example " $G\phi$ $T\phi$ 10", which instructs the computer to return to or advance to step number 10, and the three-way branch, such as "IF(X) 1, 10, 100" which transfers control to statement 1, 10 or 100 depending on whether X is less than, equal to or more than some specified number.

(Computer input-output type-writers have no lower case letters. "IF" means "if." not $I \times F$. To distinguish "O" from zero, the type-writer symbol has a diagonal line through it. In our text here this symbol is represented by " ϕ .")

Sample Program

When translated into Fortran, a language intelligible to the computer, the flowsheet of Fig. 3 for table searching and interpolation becomes the following program. The entry searched for is Z and W is the interpolated answer.

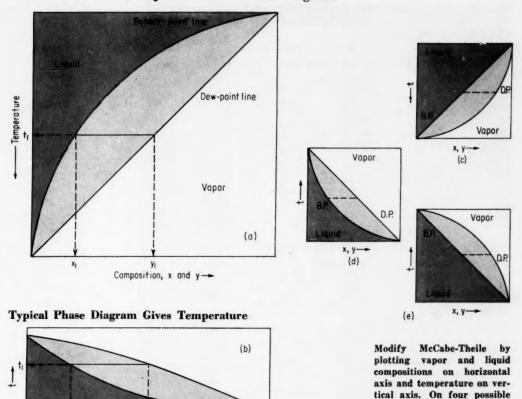
- 1 I = 1
- 2 IF(Z-X(I)) 8, 6, 3
- 3 IF(I-N) 4, 100, 100
- 4 I = I + 1
- 5 Gφ Tφ 2
- 6 W = Y(I)
- 7 G\$ T\$ 9
- 8 W = Y(I) + (Y(I) Y(I 1))/(X(I) X(I 1))*(Z X(I))
- 9 Continuation of program

100 Procedure when Z is not in range of table

A special instruction is available which performs the functions of statements 1, 3, 4 and 5 called a "D\$\phi\$" statement. A large vocabulary of instructions is available, permitting the user to program with a high degree of efficiency and flexibility while leaving most of the clerical and housekeeping work to the machine.

Details of these systems, which are rapidly being developed, are available from computer manufacturers and from the organizations which operate the machines.

New Method Adds Temperature to Familiar Diagram



Rethink Your Distillation Design

McCabe-Theile has been used for design for 34 years. Does it adequately describe your operating columns?

RALPH H. WING, West Virginia Institute of Technology, Montgomery, W. Va.

Composition, x and y-

To a generation of chemical engineers, "McCabethion design." Use of the familiar y-x graph for determination of number of distillation plates assumes, for either rectifying or stripping sections, equimolal flow: flow of vapor up the section is constant at all points; flow of liquid down the section is constant at all points.

Result of the constant molal flow assumption is that

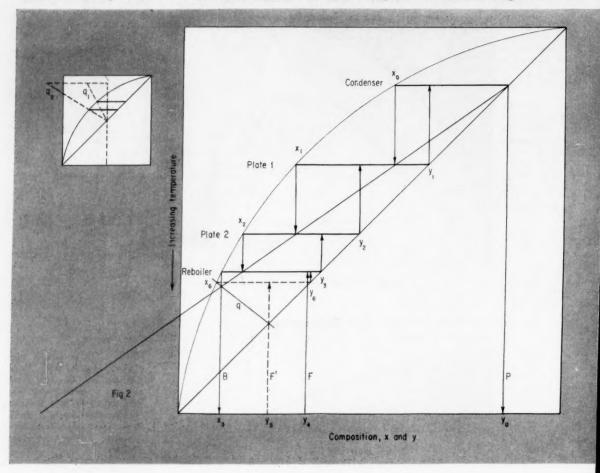
the material balance for a section of the column is a linear algebraic relation that plots as a straight operating line on the *y-x* graph. Once the operating line is drawn on the equilibrium graph, step-by-step determination of ideal plates follows easily in the well-established design technique.

Our purpose in this article is to suggest a modification of McCabe-Theile that combines the familiar

configurations, read x from bubble-point line, y from dewpoint line; also read plate

temperature.

New three-line procedure when feed lies in the two-phase region. This chart represents this



design method with some additional useful information. We believe you will get a closer grasp of the operating column from use of the modified construction that we propose here.

Use the Best of Both

The McCabe-Theile method requires plotting y (vapor phase composition) against x (liquid phase composition) for the equilibrium curve. In the new construction, Fig. 1a, the equilibrium curve is plotted on the y-x diagram as before. Then a 45° line bisecting the diagram square is drawn from the origin. Any point on this diagonal, of course, has the same value on both vertical and horizontal axes. By projecting the y value of the equilibrium curve to the 45° line, we can read equilibrium y values as well as x values from the horizontal axis.

The original curve can now be considered a bubblepoint curve—values read from it on the horizontal axis are liquid phase composition. Corresponding yvalues projected on the 45° line give the dew-point curve when read on the horizontal axis. The vacant vertical axis can be used for any other useful function—in this case, let's consider it a temperature function. The temperature function—a nonlinear one—must be determined from the t-x diagram, Fig. 1b.

Since either x or y values can be extended to either horizontal or vertical axis, and since temperature can either increase or decrease along the vertical axis, there are four possible constructions of the equilibrium data (Figs. 1a, c, d and e). The orientation shown in Fig. 1a corresponds directly with the McCabe-Theile method and will be used to explain the proposed new method. Note that the temperature function inversion corresponds to actual tower conditions.

For the simple case of rectification with feed to a reboiler, enrichment in the tower and condensation of top product, material balances can be written as:

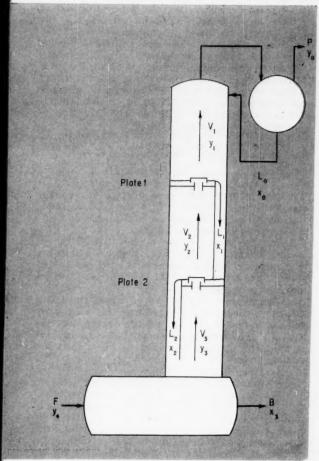
$$V - L = P$$

$$yV - xL = y_0P$$
 (1)

where V is moles of vapor rising in the column, L is moles of liquid descending, P is moles of overhead product and x, y and y, are stream compositions.

We can rewrite Eq. (2), by method of proportions,

fractionation system.



$$\frac{V}{y_0 - x} = \frac{L}{y_0 - y} = \frac{P}{y - x} \tag{3}$$

Since, for a given reflux ratio, V, L and P are constant, the ratios of $(y_* - x)$, $(y_* - y)$ and (y - x) to each other must be constant; i.e., if one term changes the other two change proportionately.

Composition y, of the product can be represented by a vertical line (see design diagram in Fig. 2), and composition y of the vapor is represented by the 45° line. A third line, the McCabe-Theile operating line, drawn from the same origin represents composition x of the liquid L. At any horizontal intercept of the three lines, the ratios of $(y_{\circ}-x)$, $(y_{\circ}-y)$ and (y-x) to each other are constant. This geometric interpretation on the design diagram corresponds to the algebraic interpretation of Eq. (3).

The horizontal intercept establishes the ratio of liquid downflow to product drawoff—the external reflux ratio. From both Eq. (3) and the diagram this reflux ratio is

$$L/P = (y_0 - y)/(y - x)$$
 (4)

Internal reflux ratio L/V can also be determined in

this way. Generally, external reflux ratio is expressed in terms of one mole of product; e.g., 6:1, 5:1, etc.

Determine Feed Conditions

A similar three-line procedure is used to define ratio of vapor to total feed when the feed lies in the two-phase region of the equilibrium diagram. In the inset diagram of Fig. 2, with a feed composition x at any temperature below the bubble point (above the bubble-point curve), the feed is all liquid. As temperature increases into the two-phase region of the equilibrium diagram, composition of the liquid phase decreases to x_1 , x_2 , etc., in equilibrium with vapor of composition y1, y2, etc. Again, by the rule of proportional parts, relative quantities of vapor and liquid are proportional to the differences in composition.

$$xF = y_1V + x_1L \tag{5}$$

$$\frac{xF = y_1V + x_1L}{\frac{V}{x - x_1}} = \frac{L}{y_1 - x} = \frac{F}{y_1 - x_1}$$
(5)

The quality of vapor is defined as

$$V/F = q = (x - x_1)/(y_1 - x_1)$$
 (7)

For easy computation, we can extend the "q" line to any convenient horizontal intercept. In the inset diagram of Fig. 2, the proportion of vapor to total feed is, at q_1 , 30/80 = 0.375, and at q_2 it is 100/150 = 0.667.

Consider the New Way

The design diagram of Fig. 2 represents the fractionation system on the right which has a partial condenser, two plates and a reboiler. If feed to the reboiler of composition y_4 enters at its dew-point temperature, no heat need be added to the reboiler, and the reboiler acts as a third plate. We make the usual McCabe-Theile assumptions of adiabatic operation, no heat of solution and equal molal heats of vaporization of both components.

Material balance over the whole system is the same as for the reflux ratio.

$$y_{\bullet}F = y_{\bullet}P + x_{\bullet}B \tag{8}$$

For P=1,

$$\frac{F}{v_0 - x_1} = \frac{1}{v_4 - x_2} = \frac{B}{v_0 - v_4}$$
(9)

from which

$$F = (y_0 - x_3)/(y_4 - x_3)$$
(10)

$$B = (y_0 - y_4)/(y_4 - x_3)$$
(11)

If feed composition changes to yo, the over-all material balance gives, for one mole of product

$$F' = (y_0 - x_1)/(y_1 - x_2)$$
(12)

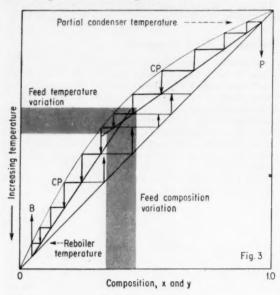
$$B' = (y_0 - y_1)/(y_1 - x_2)$$
(13)

To maintain thermal adequacy without addition of external heat to the reboiler, the new feed stream must supply the same number of moles of vapor as the original feed stream (i.e., the number of moles of vapor required by reflux ratio). For the original feed case, this is Eq. (10). Quality of the feed required for the new conditions is

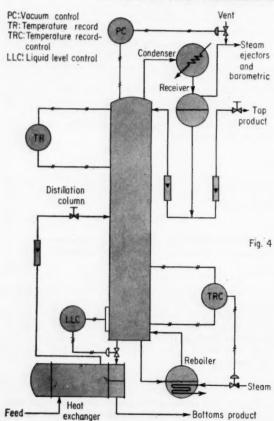
$$\frac{V}{F'} = q = \left(\frac{y_0 - x_3}{y_0 - x_3}\right) \left(\frac{y_b - x_3}{y_0 - x_3}\right) = \frac{y_b - x_3}{y_0 - x_3}$$

This q line can now be drawn from the dew-point curve at y_5 through the operating line at x_5 and ex-

New equilibrium diagram . . .



. . . for an actual installation



tended to any convenient horizontal intercept. There we can read values proportional to $(y_5 - x_5)$ and $(y_6 - x_5)$ and calculate the value for q. Intersection of the q line and the bubble-point curve locates the liquid phase composition x_5 and temperature of the feed stream; horizontal intercept with the dew-point curve locates vapor-phase composition y_5 in the feed.

There is little justification for use of a q line with positive slope since such construction indicates a feed at lower temperature than the bottom plate which is impossible without a reboiler. If external heating is used in the reboiler of a rectifying-only column, determination of q is pointless.

New Method Helped Understanding Here

The McCabe-Theile construction for a complete tower, including stripping and rectifying sections, is shown in Fig. 3, and the process Ciagram for the tower and accessories is shown in Fig. 4. The McCabe-Theile diagram is presented only to explain the concept; actual figures have not been given.

It's assumed that pressure of the system either remains constant or that controls are provided to assure this condition. Boiling points of the top and bottom products are a function of the composition. Once the tower is in operation under equilibrium conditions, these temperatures cannot change unless there is a change in composition. Composition can change by increase in flow of the most volatile component to the bottom of the tower for bottom product or by increase in flow of high-boiling bottoms to the top of the tower for top product.

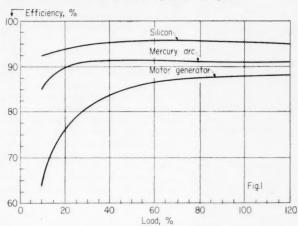
Impending composition change would therefore first become apparent a number of plates above the bottom of the tower or a number of plates below the top of the tower. In other words, a change in composition of top or bottom products must come from the feed point.

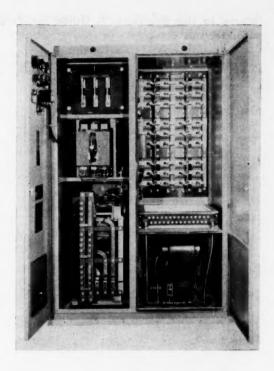
We selected control points a number of plates above the bottom of the tower for bottom product and a number of plates below the top of the tower for top product. The exact number of plates between control point and top or bottom of the tower depends on the system and the degree of control required. In this case, control points were at the third plate above the bottom and the third plate below the top. Actually, since a separate partial condenser was not used the top control point is on the fourth plate from the top.

Specifications for the bottom product called for less than 0.2% maximum of the most volatile component; a temperature recorder-controller was installed for this control. When temperature on the third plate started to fall, we knew it was due to volatile material coming down the tower. The controller increased steam flow to drive it back up.

Specifications for the top product called for a minimum of 98.0% volatile component. Since this allowed considerable leeway, the top was controlled manually by rate of drawoff of top product. The operator was instructed to watch the recorded control temperature. If it started to fall too much, volatile material was going back down the tower, and he should increase the drawoff. If the temperature started rising, the operator was taking off too much and should therefore cut back on drawoff. With an adjustment in drawoff rate about once in every four hours, the column was kept under excellent control.

Semiconductors Have High Efficiencies (500 kw., 250v. d.c.; 2,300v., 3-phase, 60 cyc.)





How to Pick the Right Rectifier

Get to know capabilities and limitations of mechanical and semiconductor rectifiers for chemical service, then choose converter which best meets your conditions.

W. E. GUTZWILLER, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

In spite of great progress made in the use of alternating current for many industrial drives, direct current has not only maintained its position as a power source, but has been on the increase.

D.c. motor sales in ratings from 1 to 200 hp. jumped approximately 80% since World War II, while a.c. motor sales are not up that much, even though a rather heavy premium must be paid for conversion equipment, d.c. distribution facilities and d.c. control.

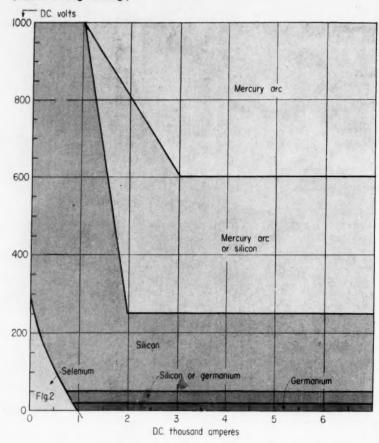
A principal reason for this startling statistic is the steady growth of automation, requiring more exacting speed control for modern process lines. And d.c. motors are almost indispensable for many applications involving fine speed adjustment over a wide range, fre-

quent starting, stopping, or reversals with dynamic braking.

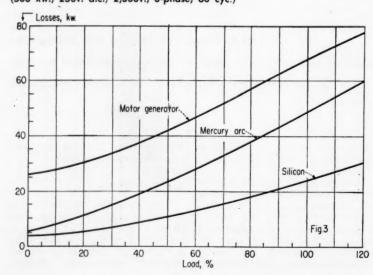
Get D.C. From A.C.

This brings up the problem of converting a.c. current to d.c., since in most cases only a.c. power is available. Conversion is handled by a number of methods in electrochemical service, for instance

Where to Use Rectifiers: A Guide for Proper Selection (Current-Voltage Ratings)



Silicon Kw. Losses Are Lowest at All Loads (500 kw., 250v. d.c.; 2,300v., 3-phase, 60 cyc.)



(Chem. Eng., Dec. 1, 1958, p. 56). Similar problems exist where d.c. is extensively used in hauling, hoisting and many other material-handling situations, as well as in magnetic devices (synchronous motor excitation).

There are a number of rectifying devices available for converting a.c. to d.c. However, each has technical as well as economic advantages and limitations. It's important to choose the correct device for a particular job, since a rectifier installation can represent a sizable capital investment. So we will examine the plus and minus factors of various commercial converters suitable for chemical process plants.

Roughly, three types exist: mercury arc, motor generator and the semiconductor. Oldest type is the motor generator, largely out of favor now. Mercury-arc converters—which depend on the rectifying action of mercury vapor—are still widely used. The latest type is the

widely used. The latest type is the semiconductor, particularly the new germanium and silicon designs (Chem. Eng., Feb. 9, 1959, p. 119). Crystal structure of these materials permits electron flow in only one

direction.

Know What's Available

Operational and economic factors greatly affect power-conversion choices. Fig. 2 shows approximate present-day current and voltage ratings of mercury-arc and semiconductor rectifiers available:

• Mercury-arc units are shown in ratings from 250 v., 2,000 amp., (500 kw.) and up, with major uses

above 600 v.

Selenium rectifiers are available only in low and medium voltages and low ampere ratings.

• Germanium rectifiers show greatest use in larger amperages with d.c. voltages from 6 to approximately 50 v.

 Silicon rectifiers are rated 20 to 600 v. d.c., from a few hundred amperes to the largest commercial

ratings.

Along with practical current and voltage ratings, over-all conversion efficiencies and conversion losses for rectifiers and motor-generator sets are important. Fig. 1 shows efficiencies for a 500 kw. rating on the three major types of conversion equipment. Note, in contrast to the motor-generator, that rectifier efficiency curves are very flat from 25

to 125% load, assuring uniformly high efficiencies under variable loads.

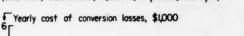
Also note from Fig. 3, that mercury-arc rectifier losses in kw. at rated load are approximately two-thirds those of the motor-generator; silicon rectifiers are about one-third that of motor generators, making the silicon rectifier losses about one-half of the mercury-arc rectifier. No-load or idling losses of both types of rectifiers are approximately 1% of the unit rating, or approximately 5 kw., one-fifth of the motor-generator.

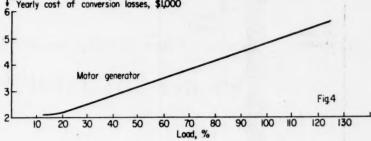
Fig. 4 shows the yearly motorgenerator losses in dollars at 1¢/kwh. (300 operating days).

Semiconducters Are Efficient

The forward voltage drop of a germanium cell is approximately 0.5 v.—one-half the silicon rectifier. This makes the germanium rectifier the most efficient conversion unit for low d.c. voltages. However, since germanium rectifier cells cannot economically be built for d.c. voltage much above 30-50 v., germanium loses its efficiency advantage at higher voltages. For

Yearly Motor-Generator Losses at Various Loads (500 kw., 250v. d.c.; 2,300v., 3-phase, 60 cyc.)





voltages higher than 30 to 50, two or more cells must be connected in series.

Silicon rectifiers, however, are available for d.c. voltages four to five times that of germanium rectifiers. Moreover, the maximum permissible cell temperature for silicon is about twice that of ger-These characteristics manium. make silicon the most desired converting unit for medium-voltage industrial rectifiers (see table be-

Controlling Voltage

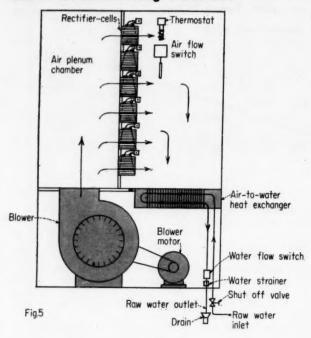
Power factor of a rectifier at rated voltage and load, always lagging, is about 90 to 93%, depending somewhat on the type of voltage regulating equipment. Unlike motor-generators, most rectifiers cannot take leading current for system power factor correction.

Phase control-retarded firing of the mercury-arc rectifier for voltage reduction-is relatively inexpensive when used only for main-

How Three Important Rectifiers Compare for Industrial Service

	Selenium	Silicon	Mercury Arc		
Economical unit ratings for 125v. d.c., constant voltage	Up to approx. 50 kw.	50 to 300 kw.	Not economical		
Economical unit ratings for 250v. d.c., constant voltage	Up to approx. 30 kw.	30 to 1,500 kw.	500 to 1,500 kw.		
Economical unit ratings for 250–575v. variable voltage, nonreversing packaged drives	Not economical	30 kw. up	Not very economical		
Economical unit ratings for 600–700v. variable voltage, heavy nonreversing drives	Not economical	Not economical	Very economical		
Conversion efficiency	Medium, deteriorates with age	Very good	Medium to good		
Power factor	90% lagging	90-93% lagging	90-93% lagging		
Life of rectifier cells and tubes	6–8 yr.	Expect unlimited life, so far less than 1% cell failures per year	12–15 yr. between tube over- hauls		
Voltage control under load	Expensive	Expensive	Inexpensive for approx. 10% range and for starting duty		
Cost of rectifier unit	Low	Medium ·	Medium to high		

Efficient Rectifier Cooling: Air-to-Water



taining constant d.c. voltage or for starting a motor or group of motors with light mechanical load. Because power factor is reduced in proportion to the amount of voltage reduction by phase control, it is not economical to operate for long periods with more than about 10% voltage reduction by phase control. Where a larger reduction under load is required, tap changing on the rectifier transformer or on a separate regulating transformer must be considered.

Semiconductor rectifiers have no inherent voltage control comparable to phase control of the mercury-arc rectifier. The a.c. voltage applied to the rectifiers must be controlled to control d.c. output. Available means of voltage control for semiconductor rectifiers are saturable reactors; on-load or no-load tap changing on rectifier transformers or separate regulating transformers; and induction regulators. Since these devices must carry the fullload current of the rectifier and must be designed to operate at the a.c. system voltage, they are more expensive than the phase control equipment of a mercury-arc rectifier.

To keep cost and losses to a minimum, range of voltage control under load should be held to a mini-

Controlled silicon rectifiers having control characteristics similar to those of the mercury-arc rectifier tube are already available in the low current and voltage ratings. It is hoped that they will make the silicon power rectifier more competitive with the mercury-arc in regard to voltage control.

Space requirements and weights of semiconductor rectifiers are about equal to those of mercury-arc rectifiers in the medium and larger kw. ratings. However, in smaller ratings, the semiconductor rectifier is much more economical in this respect.

Let's Compare Costs

While it is difficult at this time to draw a price comparison between mercury-arc and silicon converters because of many variables, particularly in regard to voltage control and methods of protection, silicon can be 10-15% lower in cost than mercury arc in the larger (250-v.) ratings. In smaller ratings, from 50 to 300 kw., silicon has an even greater price advantage over mercury arc.

With more experience on silicon rectifiers and when rectifier cells of larger current and higher voltage become available, the price advantage of silicon should rapidly

At ratings below 50 kw., selenium proves at present to be the lowest cost rectifier. Efficiency of the selenium unit, however, is lower initially than the silicon unit and, due to gradual aging inherent in selenium rectifiers, efficiency deteriorates with age. This results in eventual failure of the cells. Life of selenium cells depends on the load carried and on ambient air temperature, but experience shows average life of selenium cells in industrial service is from 6 to 8 vr.

In contrast to this, the germanium and silicon rectifier cells appear to have unlimited life, provided they are properly applied, protected, and are operated within the limits stipulated by the manufacturer (Fig. 5). Statistics indicate that yearly rate of cell failures has been less than 1% for the cells in service.

Life of mercury-arc rectifier tubes, between overhauls, runs from 12-15 yr.



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Mr. Gutzwiller is a member of the American Institute of Electrical Engineers, the Electrochemical Society and the National Electrical Manufacturers Assn.

He obtained his electrical engineering degree from Technicum Winterthur, Switzerland; is the author of numerous technical papers and holds a number of inventions and patents.

For sizing distribution systems quickly and accurately . . .

Line Sizing Chart for Gases

R. B. RITTER, Senior Engineer, Chemet Engineers, Inc., Pasadena, Calif.

There are many charts for determining the proper line size for particular flows of gases and vapors. Here is still another which you will find fully as accurate as the commonly used methods of computation.

This chart is particularly useful for sizing mains and branch lines of steam, air, or fuel-gas distribution systems in chemical processing plants and refineries. It is not intended for sizing long gas transmission lines or lines built of expensive alloys. Such special cases are best sized by individual economic studies.

Design Basis Chart

Before a line can be sized, a design basis must be established, that is, what is the allowable pressure drop per hundred feet of pipe at a given flowing pressure. Correlation of a number of commonly used guides and specifications, when plotted on the coordinates pressure drop and absolute pressure, yields Fig. 1, the Design Basis Chart. The resulting curves are labeled Design Basis = 0.5 (Mains) and Design Basis = 1.0 (Branches).

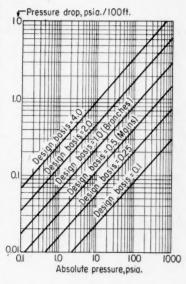
Other design bases, using identifying numbers that are proportional to the pressure drop per hundred feet, are also plotted on Fig. 1. These additional design bases permit the conversion of any line sizing guide or specification to the design basis numbers of the line

sizing chart, Fig. 2. For example, you wish to size 235 psig. steam lines for a 2 psi. pressure drop per hundred feet in the branches and 1 psi. per hundred feet in the mains. Plotting the data on Fig. 1, we see that they are equivalent to design bases of 1.5 for the branches and 0.75 for the headers.

Line Sizing Chart

Fig. 2, the Line Sizing Chart, gives line size as a function of flow-rate for any gas or vapor.

To use the chart, enter at the bottom with the flowrate, move up to a diagonal guide line, then move right to find the correct line size. The position of the guide line for a given case is determined by temperature, pressure, molecular weight and the design basis number which was obtained from Fig. 1.



Try an Example

Suppose you want to size mains for carbon dioxide at 300 F. and atmospheric pressure. First, assume the standard design bases of 0.5 for mains and 1.0 for branches, which correspond to pressure drops of 0.15 and 0.28 psi. per hundred feet respectively. If different pressure drops are desired, they may be read into Fig. 1 and the corresponding design bases read out.

Enter Fig. 2 at molecular weight = 44, move down to design basis = 0.5 (for mains), and draw a horizontal line to the right. Next, enter the temperature scale at 300 F., move up to the curve, then right to 0 psig., then down to intersect the first line. The intersection fixes the location of the guide line. Draw in the guide line parallel to the printed guide lines.

To find the line size for a flow of 6,000 lb./hr., enter the chart at 6,000 lb./hr., move up to the guide line, then right to the line size scales. An 8 in. line is required.

How Accurate Is It?

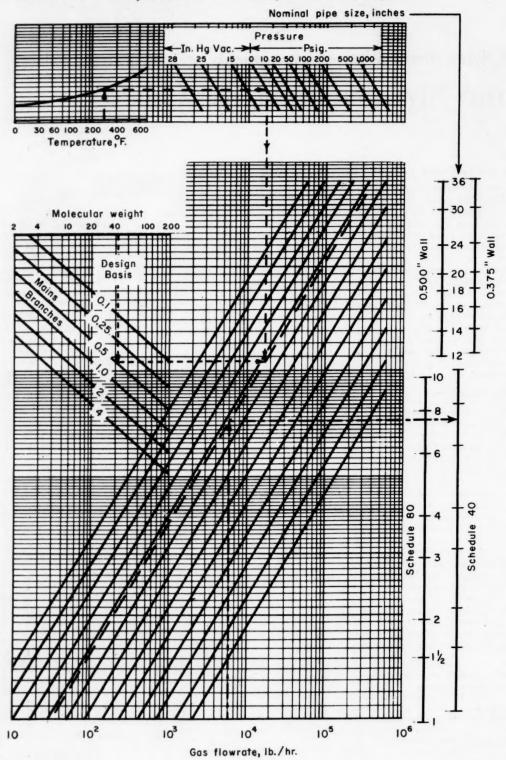
Theoretical pipe diameters for a number of test cases were computed by means of the Fanning equation using friction factors taken from Moody.¹ Gases and vapors ranging from hydrogen to mercury at flowrates from 3,000 to 200,000 lb./hr. were used. Temperatures ranged from 0 to 730 F. and pressures from 1 to 220 psi. The same problems were then run on the chart. Results were always within 2% of the computed answers.

REFERENCES

1. Moody, L. F., Trans. ASME 66, 671 (1944)
Turn page for chart, Fig. 2

R. Brown RITTER is a 1950 graduate of Ohio State and a member of AIChE and Tau Beta Pi. His background includes research in heat transfer and chemical engineering methods. Mr. Ritter is now engaged in process evaluation and engineering design of food and chemical plants.

Use Chart to Find Proper Size for Gas and Vapor Distribution Pipelines



How to Predict

pVT Relations

- A recommended equation of state and these compressibility factor charts will yield physical constants for gases.
- Then estimate vapor pressure and normal boiling point relations from pVT.

WALLACE R. GAMBILL, Union Carbide Nuclear Co., Oak Ridge, Tenn.

Our course in this installment will be to review equations of state and compressibility factor charts that apply to gases. Then, we'll review vapor pressure correlations and include estimation of the normal boiling point.

Equations of State for Gases

About 120 equations of state have been proposed, but most have experienced very little use, generally because of either poor accuracy or cumbersome formulation. If gas densities at a few conditions are to be calculated, the engineer will usually find one of the z charts discussed in the next section to be sufficiently accurate and much more convenient.

However, equations of state are of great value to

- Represent experimental data precisely.
- Interpolate known data accurately.
- Compute thermodynamic functions from derivatives of pVT relations. Accordingly, we will briefly review eight of the more generally applicable equations of state. For general discussions of

the bases of equations of state, see Refs. 1-3.

We will assume that the reader is familiar with the perfect gas law. Also, we will skip over most of the older equations such as those of van der Waals, Berthelot, Goodenough, Linde, Clausius, Callendar and Lees.

One older relation which still sees much use is the empirical virial expansion form:

$$p = \frac{RT}{V} + \frac{B}{V^2} + \frac{C}{V^3} + \frac{D}{V^4} + \dots$$
 (1)

which may also be written as:

$$z = \frac{pV}{RT}$$

$$= 1 + \frac{B'}{V} + \frac{C'}{V^2} + \frac{D'}{V^3} + \dots$$
 (2)

In these equations B, C, D and B,' C,' D' are the second, third and fourth virial coefficients, respectively, and are functions, often complicated, of T only. As density increases, an increasing number of virial coefficients are needed to represent gas behavior accurately.

The Dieterici equation:

$$p = \frac{RT}{V - b} e^{-a/VRT} \tag{3}$$

was later modified to:

$$p = \frac{RT}{V - h} e^{-h} \tag{4}$$

where $k=aT_{\sigma}^{1/2}/VRT^{8/2}$

Still later, Joffe modified Eq. (4)

$$p = \frac{RT}{V-b} - \frac{R(TT_e)^{0.5}}{V-b} (1 - e^{-a/VRT})$$
 (5)

Constants a and b in Eqs. (3) to (5) may be evaluated from the critical constants as follows:

$$a = 4R^{2}T_{e}^{2}/p_{e}e^{2}$$
 (6)
 $b = RT_{e}/p_{e}e^{2}$ (7)

where ε is the base of natural logarithms. Joffe showed that Eq. (5) is the most accurate of the three forms.

An excellent three-constant equation of state is that proposed by Wohl':

$$p = \frac{RT}{V - b} - \frac{\alpha}{V(V - b)} + \frac{c}{V^3} \quad (8)$$

the constants of which may be evaluated from:

$$a = 6p_eV_e^2
b = V_e/4
c = 4p_eV_e^3$$
(9)

Though inaccurate for reduced densities greater than unity, Eq.

(8) was tested and found to show a maximum error of approximately 1% up to ρ , = 1. Recently, Hobson and Weber applied the Wohl equation to gas mixtures with good success in the superheated region and with only fair accuracy for saturated vapors.

The Redlich-Kwong equation of

$$p = \frac{RT}{V - b} - \frac{a}{T^{0.5}V(V + b)}$$
 (10)

is perhaps the best of the two-constant relationships. The constants may be calculated from:

$$a = 0.4278R^{2}T_{e}^{2.5}/p_{e}$$

$$b = 0.0867RT_{e}/p_{e}$$
(11)

A later comparison showed Eq. (10) to give a good fit to experimental pVT data.

The four-constant McLeod equation of state¹²:

$$\pi(V - b') = RT \tag{12}$$

where $\pi=(p+a/V^s)$ and b'=A $-B\pi+C\pi^s$ was investigated by Rush and Gamson's who found general graphical correlations in terms of the critical constants for the constants of Eq. (12). An extension of Rush and Gamson's approach was published by Kobe and Murti.14

Beattie - Bridgeman equation may be written as follows:

$$p = \frac{RT(1-f)}{V^3} (V+B) - \frac{A}{V^3}$$
 (13)

where
$$A = A_{\bullet}[1 - (a/V)]$$

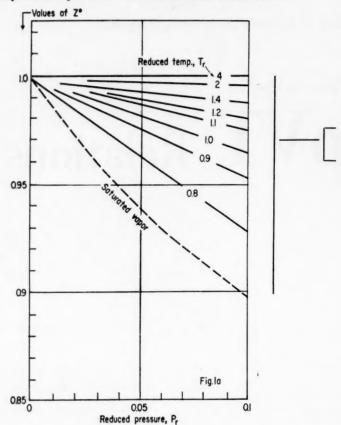
 $B = B_{\bullet}[1 - (b/V)]$
 $f = C/VT^{\bullet}$

Reliable values are found from Eq. (13) up to $\rho_r \cong 1.0$. In the original evaluation, the average deviation was only 0.2%. The five constants have been tabulated for 19 gases by Dodge.¹⁸

Benedict-Webb-Rubin equation¹⁷ has been applied with excellent success to hydrocarbons. This relation

Compressibility Factors at Low Reduced Pressures

14 St. 3



which is quite accurate up to $\rho_r \cong 2.0$ is given below:

$$p = RTd + [B_oRT - A_o - C_o/T^2]d^2 + (bRT - a)d^3 + a\alpha d^6 + [cd^3(1 + \gamma d^2)/T^3] \exp(-\gamma d^2)$$
 (14)

The eight constants of this equation of state have been calculated for

some light hydrocarbons^{15,10} and for benzene.²⁰ Alignment charts for rapid solution of Eq. (14) were recently published.²¹ For the light hydrocarbons, Canjar²² has correlated the eight constants with T_o.

The ten constant Martin-Hou equation of state⁸:

$$p = \frac{RT}{V - b} + \frac{A_2 + B_2T + C_2(\exp T_{\tau}/239)}{(V - b)^3} + \frac{A_3 + B_3T + C_4(\exp T_{\tau}/239)}{(V - b)^3} + \frac{A_4}{(V - b)^4} + \frac{B_4T}{(V - b)^5}$$
(15)

is one of the most useful of all the multiconstant, highly accurate equations. Only T_e , p_e , V_e and one vapor pressure point must be known for its application.

To evaluate the constants of Eq.

Nomenclature.

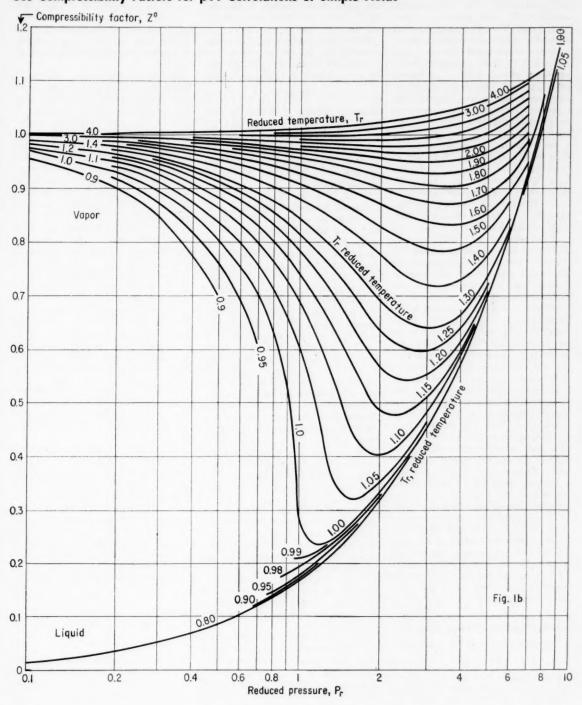
- M Molecular weight.
- n Refractive index.
- Absolute pressure.
- [P] Parachor.
- pro Reduced vapor pressure.
- R Universal gas constant.
- $[R_D]$ Molar refraction.
- T Absolute temperature.
- V Molar fluid volume.
- V. Molecular volume at T.
- x Component, mole fraction. z Compressibility factor = pV/RT.
- Other symbols denote constants.

- Riedel parameter.
- Residual volume in Eq. (19).
- Molar fluid density.
- ω Acentric factor in Eq. (20).

Subscripts

- b At normal boiling point.
 - At critical point.
- i ith component.
- L Liquid.
- pc Pseudocritical.
- Reduced.
- Vapor.

Use Compressibility Factors for pVT Correlations of Simple Fluids



For more information and source of Figs. 1a, 1b and 2, consult Refs. 56 and 61. (15), follow the steps in the original reference.* The Martin-Hou equation fits both polar and nonpolar gases. The original evaluation showed a maximum error in pressure for seven gases of only 1.1% for ρ , and T, up to 1.5 and an average error of only 0.4%. In a recent modification, two more constants were included in the Martin-Hou equation. This gives somewhat better data representation in the region of ρ , \cong 1.4.

An even more complicated equation of state, suitable for digital computer evaluation and accurate over very broad ranges, has been proposed by Hirshfelder and others.³⁰ Further interesting information relative to equations of state may be found in Refs. 24 to 31.

Experimental pVT data for gas mixtures have been compiled by Tang. Calculation methods include the simple Amagat additive-volume, Dalton additive-pressure laws and combination of equation of state constants for pure substances to obtain mixture constants. However, the simplest generalized rules are those of Kays and of Joffes for obtaining pseudocritical constants for use with z charts. Kay's method will be stated in the next section.

No single equation of state, when compared with other equations of equal complexity, is best under all conditions. The relative accuracy of comparable equations varies with the gas under consideration and even with conditions for a given gas. Equations containing more constants give better data representation but are offset by the greater time required for their use.

Of the equations considered here, Eqs. (5), (8), (10) and (12) combine reasonable realism with simplicity and meet many engineering requirements. For broader ranges of gas density, or for very precise results, Eqs. (13), (14) and (15) are recommended.

Compressibility Factor Charts

Ideal-gas equation of state:

$$pV = RT \tag{16}$$

may be made to coincide with experimental pVT data in ranges where it otherwise would not by inclusion of a correction or compressibility factor z:

$$pV = zRT \tag{17}$$

The factor z has been graphically correlated with other parameters,

usually T_r and p_r . There are twentyone such charts known to the author. These are listed chronologically in Refs. 36 through 56.

With two exceptions, the compressibility factor correlated is z = pV/RT from Eq. (17). In Ref. 42, a_r is plotted vs. T_r and p_r where:

$$\alpha_{r}' = \alpha'/\alpha_{\theta}' \tag{18}$$

Residual volume a' which is zero for a perfect gas is given by:

$$\alpha' = (RT/p) - V \tag{19}$$

In Ref. 50, the factors correlated are the ratios of pV to $(pV)_{ref.}$ or Amagat units.

Until 1951, the best charts were those of Edmister⁴² and Maxwell⁵¹ for hydrocarbons; and of Dodge,⁴⁰ Su⁴² and Worthington Corp.⁵⁰ for general application. For the last three charts, average and maximum errors are about 2 to 3% and 15%, respectively.

The Maslan and Littman chart³⁰ applies specifically to hydrogen and the inert gases helium, neon and argon. This chart should always be used for these gases, and especially for $T_r < 2.5$ where the usual charts are quite inaccurate for these substances. The Maslan-Littman chart covers a T_r range from 0.8 to 15.0 and a p_r range 0 to 130.

Nelson-Obert z chart³⁴ resulted from a very extensive investigation of all experimental gas and gas mixture data available through 1952. It is the best compressibility chart available which utilizes only T, and p, to correlate z. Averaged data for 30 gases were used in its construction.

Lines of constant ideal reducedvolume are plotted on the four Nelson-Obert charts so that T, p and Vmay be directly calculated. Davis¹⁷ has published a nomograph for the low-pressure range $(0 < p_r < 0.1)$ for the Nelson-Obert charts. Depending on the $T_r - p_r$ range, the maximum error of these charts is in the range of 1 to 5% with very few exceptions.

Hall and Ibele⁸⁰ attempted to reduce the deviations of polar gases from the usual z charts by first correlating a z_{*id} . with T_* and $RT_*/\rho p_*$ for argon, krypton and xenon. This correlation would be expected to follow very closely the law of corresponding states. Deviations of z for real gases from z_{*id} . were then correlated with molecular dipole moment. Data necessary in this method are not sufficiently

available to meet the broad requirements of engineering applications.

These attempts to correlate z more accurately than can be done with T, and p, alone have been put on a more generalized basis in three ways.

In one instance, the z factor at the critical point z_c has been used as a third correlating variable. For the great majority of substances, $0.25 < z_c < 0.29$, but z_c may range from 0.18 for HCN to 0.31 for H_z. Meissner and Seferian first used z_c for z correlation, and this approach was followed by Lydersen, Greenkorn and Hougen's who tabulated z vs. T_c and p_c for each of four values of z_c (0.23, 0.25, 0.27 and 0.29).

More recently, Hamrin and Thodos³⁰ have graphically correlated the densities of the inert gases in two ρ_r vs. T_r and p_r plots. One plot covers argon, krypton and xenon $(z_e = 0.291)$ and the other, neon and helium $(z_e = 0.307)$. These plots may be used for other substances with similar z_e values and appear to give errors of 1.5 to 2.5%. A similar plot³⁰ has been published for gaseous and liquid hydrogen over very broad ranges which correlate the data within about 0.5%.

Another correlating parameter which has been used is the slope of the $\log p_{\circ} - \log T$ curve at the critical point which is usually denoted

by a.

In its early stages, the last additional variable for pVT correlation which we will consider was known as the imperfection parameter η , but is now called the acentric factor ω . This approach has been developed by Pitzer and co-workers, whose published tabular data were plotted by Edmister to give what is probably the best all around z chart available today.

The acentric factor is defined by:

$$\omega = - (\log p_{r*} + 1) \tag{20}$$

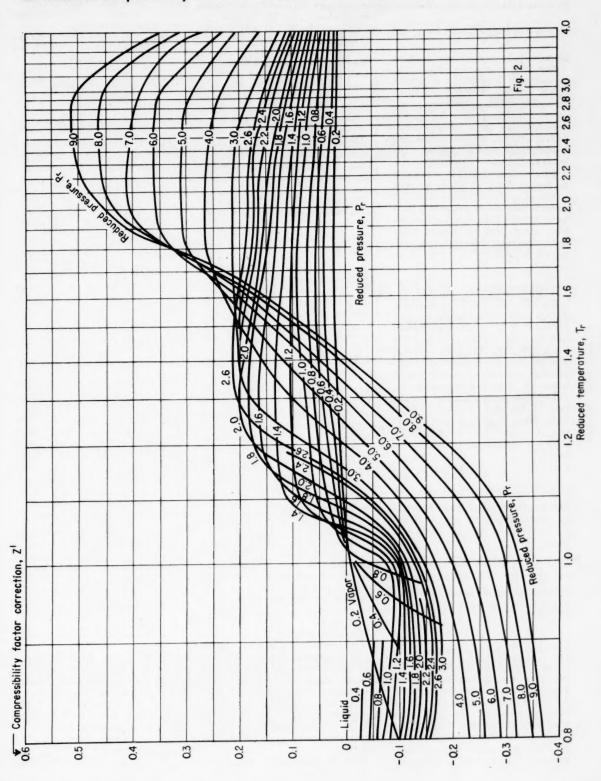
where $p_{rr} = p_{r}/p_{o}$ at $T_{r} = 0.7$. In turn, z is obtained from:

$$z = z^0 + \omega z' \tag{21}$$

where $z^{\circ} = z$ for a simple fluid and z' = correction to z for deviation from a simple fluid. Values of the constant z° as a function of T, and p, are given in Figs. 1a and 1b, and values of z' for the same functions are given in Fig. 2.

Edmister⁵⁰ also gives separate plots for z⁵ and z' of saturated vapors and liquids. The acentric fac-

Correction to Compressibility Factors for Deviations From Simple Fluid



tor may be estimated where vapor pressure data are insufficient from:

$$\omega = \frac{3}{7} \left[\frac{\log p_e}{(T_e/T_b) - 1} \right] - 1 \quad (22)$$

where p_* is in atmospheres absolute. For 32 compounds, Eq. (22) agrees with ω based on p_* within 16.5% average. For hydrocarbons, excluding methane, the average error is 3%. The error in ω appears to exceed 10% for ω <0.05. Slightly better over-all agreement is obtained if the constant of Eq. (22) is changed from 3/7 to 0.425.

This method should be applicable to gas mixtures if molar average values of ω , T_e and p_e are used but no tests with gas mixture data have been made. The accuracy of the plots when used for highly polar molecules has not been fully ascertained.

Recommendations

For hydrogen and the inert gases, always use the chart of Maslan and Littman[®] if $T_r < 2.5$. For hydrocarbons only, the Maxwell chartⁿ is probably preferable. For general use, the Edmister plots[®] offer the greatest accuracy at the expense of somewhat greater complication.

The Nelson-Obert charts⁴⁴ are the best of the simpler z-T, -p, type. They should be used for gas mixtures with calculated pseudoreduced temperatures and pressures:

$$T_{r'} = T/T_{ps} \tag{23}$$

$$p_{\tau}' = p/p_{\tau} \tag{24}$$

Pseudocritical constants T_{pe} and p_{pe} may be estimated with the simple linear molar average method of Kay:³⁴

$$T_{pe} = \sum x_i T_{ei} \tag{25}$$

$$p_{pe} = \sum x_i p_{ei} \tag{26}$$

or with the more complicated but slightly more accurate equations of Joffe.**

Estimate Vapor Pressures

An extensive compilation of smoothed experimental vapor pressure data has been made by Stull^{as} for about 1,200 organics and 300 inorganics with 993 references. Further tabulations and graphical presentations of vapor pressure data may be found in the books of Timmermans, ⁴⁶ Dreisbach⁴⁶ and Jordon. ⁵⁷

We have already touched on vapor pressure correlation forms to some degree in the section dealing with latent heats of vaporization (*Chem. Eng.*, Dec. 1957; Jan. 13, 1958 and Feb. 10, 1958).

The simplest approach to obtain a complete vapor pressure curve is to plot $\ln p_*$ vs. $1/T_*$, as a straight line using only T_* and known or estimated values for T_* and p_* . This two-point line may also be constructed by plotting p_* for the compound vs. p_* of a reference compound at the same T_* on log-log paper. Either method is surprisingly accurate if the input data are good.

The best of the simpler p_* correlation methods is the Antoine equation.

$$\log p_* = A - \frac{B}{T + C} \tag{27}$$

A graph of Eq. (27) is called a Cox chart and is usually fitted to multipoint data by least squares. If two boiling points are known, the constants may be calculated from:

$$B = \frac{[\log (p_1/p_2)](T_1 + 230)(T_2 + 230)}{T_1 - T_1}$$
 (28)

$$A = \log p + B/(T + 230)$$
 (29)
 $C = 230$ (30)

where units for p are mm. of Hg and for T are C° .

Rate of change of vapor pressure with temperature may be calculated from Eqs. (31) or (32) which are obtained by differentiation of Eq. (27)

$$\frac{dp}{dT} = \frac{2.303Bp}{(T+C)^2} \tag{31}$$

or:
$$\frac{dp}{dT} = \frac{2.303p(A - \log p)^2}{B}$$
 (32)

Thomson[®] reviewed the Antoine and other equations in detail and concluded that best accuracy over the entire liquid range is obtained by using two equations. One equation is fitted with data up to $T_r = 0.85$, the other with data from $T_r = 0.85$ to 1.0.

However, others of feel that one Antoine equation is suitable up to T, of approximately 0.95. It has been shown that Eq. (27) is quite accurate when the three constants are evaluated from data. When Eqs. (28) to (30) are used with two boiling points, the method loses accuracy for T_b less than 250 K. or for highly polar compounds below $T_r = 0.65$.

For hydrocarbons only, the

graphical correlations of Myers⁷¹ and of Myers and Fenske⁷² are excellent for low- and high-boiling compounds respectively.

An analytic correlation which has been recommended by Hirschfelder and others,²⁸ is Riedel's:⁷⁸

$$\ln (p_*/p_*) = \alpha \ln T_r + 0.0838(\alpha - 3.75)(B)$$
 (33) where

$$B = \frac{36}{T} - 35 - T_r^6 + 42 \ln T_r$$

If a boiling point is known, evaluate a in Eq. (33) by using the following equations:

$$\alpha = \frac{0.314\phi(T_b/T_e) - \ln(p_b/p_e)}{0.083\phi(T_b/T_e) - \ln(T_b/T_e)}$$
(34)

vhere

$$\phi\left(\frac{T_b}{T_e}\right) = 36\left(\frac{T_b}{T_e}\right)^{-1} - 35 - \left(\frac{T_b}{T_e}\right)^{\bullet} + 42\ln\left(\frac{T_b}{T_e}\right)$$
(35)

When the boiling point is unknown, estimate a by using the acentric factor²⁰ \omega:

$$\alpha = 5.808 + 4.93\omega \tag{36}$$

or, compressibility factor 2.:

$$\alpha \cong 7 + \frac{1 - 3.72z_s}{0.26z_s}$$
 (37)

The correlation given by Eq. (33) is good for most liquids but not for water or ammonia. Reid and Sherwood™ have also tested Eq. (33) with good results and report about 10% maximum error over the liquid range. Other vapor pressure correlations which may be of interest are included in Refs. 74 to 80.

Find Normal Boiling Points

An important parameter in many generalized estimation methods is the normal boiling point. Since T_b is easily measured, a large amount of data exist for it. In the rare cases where it might be unavailable, use Meissner's methodⁿ to estimate T_b .

$$T_b = \frac{637[R_D]^{1-q_0} + B}{[P]} \tag{38}$$

where $T_b = {}^{\circ}\text{K}$. Molar refraction $[R_D]$ and parachor [P] are to be evaluated by summation of the additive constants as given in *Chem. Eng.*, July 1957, Table III, p. 267. The constant B varies with chemical typeⁿ as shown in Table I.

Average and maximum errors for T_b expressed as °K. from Eq. (38) are 2.04% and 7.3% respectively



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Use Correct Value of Constant in Eq. (38)—Table I

	\boldsymbol{B}
Acids, monocarboxylic	28,000
phenols, cresols, etc	16,500
Amines, primary	6,500
Amines, secondary	2,000
Amines, tertiary	-3,000
Esters of monocarboxylic acids	15,000
Esters of monohydroxy alcohols.	15,000
Ethers and mercaptans	4,000
Esters of dibasic acids	30,000
Esters of monohydroxy alcohols.	30,000
Hydrocarbons, acetylenic	-500
Hydrocarbons, aromatic	-2,500
Hydrocarbons, paraffinic	-2,500
Hydrocarbons, naphthenic	-2,500
Hydrocarbons, olefinic	-4,500
Ketones	15,000
Monochlorinated normal paraffins	4,000
Nitriles	20,000

See Ref. 81 for source of material in this table.

for 32 compounds including six alcohols.

In another study, the following equation was derived from a correlation for T_c which had been proposed by Watson.

$$T_b = \frac{\theta}{(V_b)^{0.18}} \exp \left[\frac{2.77 (V_b)^{0.18}}{\theta} - 2.94 \right] (39)$$

Value of $\theta = T_b/T_c$ may be calculated from Eqs. (3), (4) or (5) shown in an earlier article, Chem. Eng., June 15, 1959, p. 181. Molar volume at T_b-V_b may be computed from the following equation: $\rho_b = M/V_b$.

For 33 compounds, Eq. (39) gave average and maximum errors⁵⁰ in T_b as °K. of 4.6% and 22.2% respectively. Other methods for estimating T_b include Kinney's boiling point numbers⁵⁰ and a recent article⁵¹ dealing with organic compounds.

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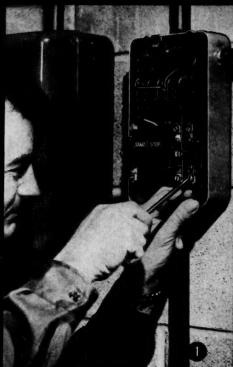
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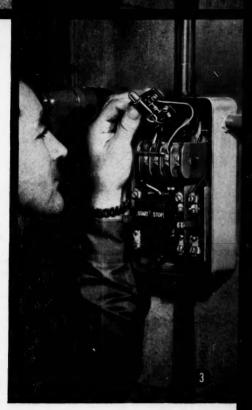
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factors makes it possible to apply local wage rates to these tasks. Mr. Clark is an officer of the American Association of Cost Engineers.

Rough Carpentry Labor

Type of Work	Man-hr./ 1,000 fbm.
Mud sills	80
Stud walls, exterior	30
Stud walls, interior	29
Floor joists	15
Bridging	100
Roof framing	33

Type of Work	1,000 fbm.
Rough flooring, straight	15
Rough flooring, diagonal	18
Roof sheathing	21
Wall sheathing, straight	17
Wall sheathing, diagonal	22
Corner boards	20 lin. ft./hr.
Fassia board	20 lin ft /hr

Man-hr./

Finish Carpentry Labor

Doors	
Frames (2'8"×6'8" to 3'0"×	
7′0″)	1.2 man-hr. ea.
Trim (two sides)	
Doors (no locksets)	1.2
Wood sash	
Frames (to 5'×6')	1.5 man-hr. ea.
Sash (to 5'×6')	2.2
Trim (to 5'×6')	1.5

Finish hardware	е									
Locksets										1.0 man-hr. ea.
Door closers										1.0
Kick plates										1.0
Thresholds							,	*	e	1.0
General										
Baseboard						9				15 lin. ft./hr.
Chair rail		*								30
Picture molding										30

Wall and Ceiling Finish Labor

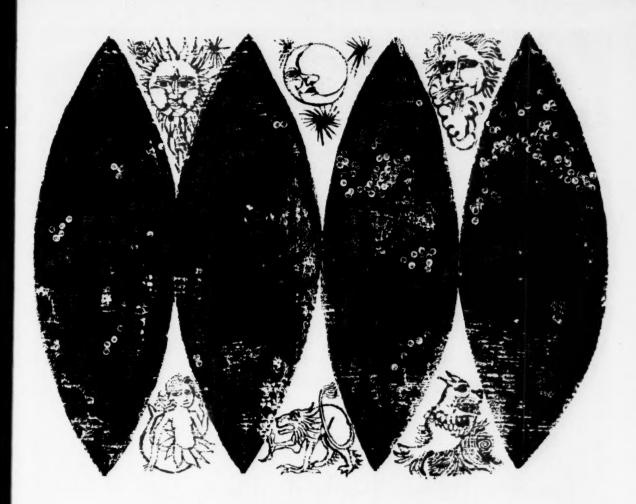
Plaster board*	
Large rooms (>300 sq. ft.)	80 sq. ft./hr.
Small rooms (< 300 sq. ft.)	50
Ceiling	60-80
Taping. (Prior to painting or	
texturing, conceal joints and nailheads; apply a 2½ in. wide tape over joints and putty the	
nails. Experienced taper.)	80
Acoustic Tile	
Nailing attachment	25 sq. ft./hr.
Adhesive attachment	

Plaster (3-step operation)	
Lath; perforated gypsum on wood stud	12 sq. yd./hr.
Corner reinforcing; metal corner	
beads	30 lin, ft./hr.
Plastering	
Scratch coat	16 sq. yd./hr.
Brown coat	11
Finish coat	11
(These factors for ordinary workmanship; if all corners must	
be plumb and waves held to	
1/16 in. maximum, add 30% to	
corner reinforcing and plaster-	

*Unless openings exceed 20% of total area, lump them in gross area.

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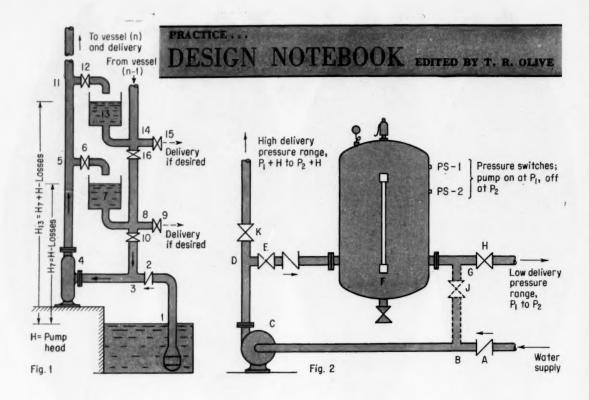
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How to Boost Available Pumping Head

For applications where batch pumping is acceptable, you can pump to a higher head—without a new pump—by pumping in stages.

★ Winner of the August Contest by John Boresta, Engineer, West Englewood, N. J.

Here's an idea that will enable you to boost the head you can get from a centrifugal pump, provided you are willing to sacrifice capacity and continuity. What it amounts to is that you do your pumping in two or more stages at increasingly higher heads, completing each stage before the next can be started. Since the delivery from the system is taken only from the last stage, then the total capacity that can be delivered during a period of time varies inversely with the number of stages, while the delivery becomes a batch rather than a continuous proposition.

For certain purposes where a higher head is needed, the reduced capacity and intermittent delivery will not be disadvantageous. For example, I have used the system to get higher pressure that I needed for washing filters.

The easiest way to visualize what goes on is with the aid of Fig. 1. Consider that the pump draws from a reservoir at 1 and discharges to an elevated vessel at 7, high enough to utilize the available head of the pump at a suitable capacity. In this case the circuit is 1, 2, 3, 4, 5, 6 and 7. If desired, the liquid could be

delivered at the level of 9, valve 10 being closed.

Now, suppose that we want to raise the liquid to a still higher level than that of vessel 7. Instead of taking suction from the reservoir 1, we can take suction from vessel 7 (check valve 2 being closed) and so add the head available from the pump to the head already available from the suction level in vessel 7. In this way the liquid can be pumped from vessel 7 to vessel 13. Similarly, in n stages, it is possible to pump to vessel n, at a total height of H_n above reservoir 1.

The catch in all this, of course,



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is that there are pumping losses in each stage and these losses are cumulative. Consequently, the height that can be added with each succeeding step becomes less so that after a few stages it would not be worth while to attempt to go farther. If the pumping head available at reasonable delivery is H, then the total head available from a multistage system such as this will be nH, less the sum of all the friction losses in each of the stages.

Before attempting this system, be sure to check whether the pump and piping can support the

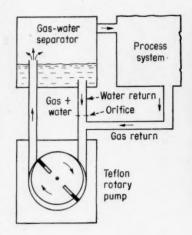
added pressure.

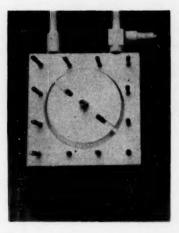
The first time I used this method was to increase the pressure from a hydro-pneumatic accumulator as shown in Fig. 2. I badly needed the higher pressure for washing some filters but had neither time nor money to get a second pump. So, I added the dotted bypass BG and a few manual gate valves to get the desired higher pressure.

Here's how the system worked. Water was introduced into the accumulator via the circuit A, B, C, D, E and F, valves H, J and K being closed. This compressed the air in the accumulator from P, to P, Pressure switches set for P_1 and P_2 were used to start and stop the pump. When the pressure reached P_s we opened valves J and K and closed valves H and E. Now, the pump was started manually, taking suction at pressure Ps from tank F and boosting the delivery to a range of pressures from H +

 P_s to $H + P_1$. On reaching the lower delivery pressure, the valves were returned to the orig-

inal arrangement and the accumulator again pumped up to pressure P_{s} .





Plastic Pump Handles Gases

Merton Allen

Chemical Engineer, General Electric Co., Schenectady, N. Y.

In one of our laboratory experiments we needed to circulate corrosive hydrogen iodide gas through a series of glass vessels. The system operated at or near atmospheric pressure and the total pressure drop was only a few inches of water.

Teflon was indicated as the desired construction material for

the pump but we were unable to locate a vendor of a suitable design. In fact, we found very few pumps of any material designed to handle gases at only a few inches of water pressure drop. It was out of the question to use a centrifugal blower or fan since a positive seal across the pump was necessary.

The upshot of it was that we built the Teflon rotary vane pump illustrated in the view above. The diagram shows how it was hooked up with a water reservoir and separator so that a small trickle of water, which soon became saturated with HI gas, could be used to lubricate the pump parts. The pump itself was kept cool with an external water spray. The water flow to the pump was regulated by an orifice in the water return line.

All pump parts in contact with the gas were Teflon, the Monel shaft being isolated from the gas by the tight fit of the rotor in the pump housing. The pump subsequently worked well in other applications on corrosive liquids and gases.

NEXT ISSUE: Watch for September Contest Winner

* How Readers Can Win

\$50 Prize for a Good Idea—Until further notice the Editors of Chemical Engineering will award \$50 each four weeks to the author of the best short article received during that period and accepted for Plant or Process Design Notebook.

Each period's winner will be announced in the second following issue and published in the third or fourth following issue.

\$100 Annual Prize—At the end of each year the period winners will be rejudged and the year's best awarded an additional \$100 prize. How to Enter Contest—Any reader (except a McGraw-Hill employee) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at space rates (\$10 minimum).

Articles should interest chemical engineers in development, design or production. They may deal with useful methods, data, calculations. Address Plant & Process Design Notebooks, Chemical Engineering, 330 W. 42 St., New York 36, N. Y.



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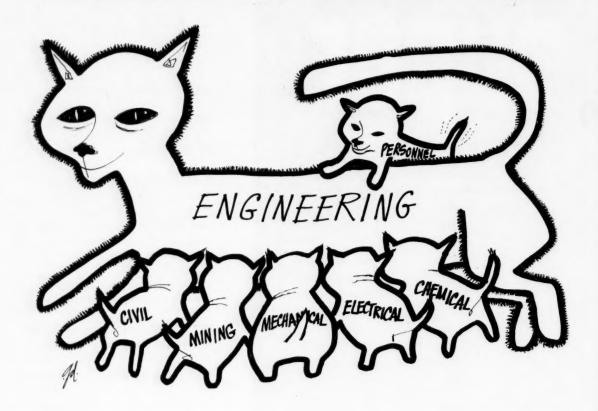
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Enter a New Breed: Personnel Engineer

Managing the intricate personnel problems that surround engineering manpower may itself call for engineering skill. Here's an authoritative profile of our newest discipline.

from Mars, flying saucers and spaceships, our technological era has nurtured another new phenomenon: the personnel engineer.

▶ What's That?—Briefly, a personnel engineer is one who

nel," and may also be responsible for other duties.

At first glance this might not seem to be too exciting, but neither would the job of a mountain climber if you de-

R. J. Obrochta, Personnel Engineer,
Along with little green men
from Mars. flying saucers and engineers and technical person

Convair (San Diego), Div. of General Dynamics Corp.
scribe it as "one who climbs mountains," or that of a physician as "one who makes sick people well," and so on.

Challenge, excitement and opportunity are all part of these jobs and the same applies to the work of personnel engineering.



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How Ten Companies Define Personnel Engineering*

- Q. What job titles are included in your personnel engineering program?
- A. Technical recruiting coordinator. Technical personnel recruiter. Personnel representative.

Employment supervisor. Personnel manager.

Q. What are the educational requirements for a career in personnel engineering?

A. Of the companies responding, 50% prefer an engineering degree (but it's not mandatory) supplemented by such courses as: psychology; industrial management; business administration; sales.

Q. What personality traits do you consider to be important for success in personnel engineering?

A. "Maturity. Some experience in dealing with technical people, either as a result of technical degree or experience."

"Must have ability and personality to (get)... the student or prospect to open up and commit himself as to his abilities and desires."
"Ability to grasp engineering concepts and organizational structure."

Q. What annual salaries do you pay to your personnel engineers?

A. Less than five years of experience: \$6,600 to \$10,000.

More than five years but less than ten years of experience: \$8,100 to \$13,000.

More than ten years of experience: \$9,540 and up.

* Companies contacted: 25; companies responding: 10

Where do you find personnel engineers? You won't even find the title listed in the "Dictionary of Occupational Titles," the U.S. Dept. of Labor's official publication for classifying and defining jobs. The job is too new; and furthermore, the personnel engineer is known by as many different titles as there are companies.

► Qualifications Needed — Personnel engineering appeals to the engineer who has a flair for meeting and working with people rather than things.

A "straight" engineer just does not fit in this job. It calls for an adaptable personality; one which is flexible and able to play many roles. Lon Chaney, for instance, the man of a thousand faces—if more of them were laughing instead of leering—would probably have been able to play the roles demanded of the personnel engineer.

On the one hand, he must be warm and friendly, outgoing, able to establish rapport with others and to draw out engineers so they will talk about themselves. On the other hand,

he must be critical, probing and objective so he can evaluate an engineer's qualifications in the proper perspective.

As if this isn't enough, he then has to be persuasive to "soft sell" the engineer on the company he represents.

► Three Settings—The personnel engineer plays his roles in three major settings:

• The home office. Here he plays the role of personnel or employment manager.

• Out of town in the hotel suite. Here he is a field personnel representative.

On the college campus.
 Here he is the college recruiter and good-will ambassador.

At the home office, the personnel engineer performs his usual employment functions of interviewing and placing qualified applicants. In addition, the "other duties" part of his job becomes rather important. He's responsible for employee counseling, supervisor-engineer interrelations, wage and salary problems, personnel research, and community and general public relations.

Oftentimes employees with on-the-job problems come to him for direction and to get a point of view. Even though employees are encouraged to go to their immediate supervisors with their questions, there are times when the employee finds this to be unfeasible and so he seeks out a neutral party.

The personnel engineer may assist in reflecting and clarifying negative feelings of the employee; corroborating information relative to company activities, reorganizations, or what-have-you that affect job security. He has to be versed in counseling techniques, as occasions like this do arise especially if the personnel engineer and his group have the word-of-mouth reputation and confidence of the engineering department.

► An Objective Listener—Sometimes a supervisor and a technical man come to the personnel engineer to talk about a situation that they cannot resolve. The personnel engineer can be extremely objective in cases like this.

He has no ax to grind, so his decisions are relatively unbiased.

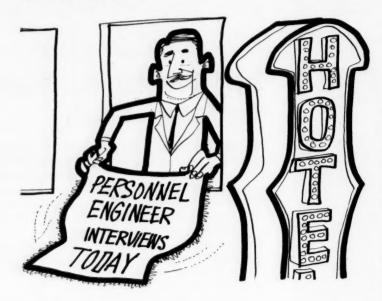
The supervisor-engineer relationship problem might simply involve an interpretation of company policy, or it might involve personality differences. This calls for an arbitrator who can offer a straightforward opinion.

Wage and salary responsibilities are sometimes assigned directly or indirectly to the personnel engineer. Obviously, these duties would vary with the individual and the organization.

Each job offer made to an applicant can be determined initially by the interviewing personnel engineer, subject to approval by the wage and salary department. Depending on the company, merit increases and reviews might be a direct responsibility of the personnel engineer. If it is, he must review the progress of each engineer with his respective supervisor to determine the amount of increase to be granted, if any.

Similarly, with reclassifying employees into other jobs, the





personnel engineer is instrumental in effecting such a change. As mentioned before, the wage and salary function varies greatly from one company to the next. So it's difficult to give a flat statement on this responsibility.

Personnel research projects could range from causes of labor turnover to what's the best way to recruit engineers and scientists. Analysis of labor turnover includes the examination of exit interview reports to determine employees' reasons for leaving; comparing turnover figures for the current period with the curves for the corresponding period last year; or a hundred other possible approaches.

A number of diverse activities come under the heading of public and community relations. Community relations could mean a bright-eyed youngster who walks into the office and asks to be told "all about engineering"; or a phone call from one of the local schools asking for your participation in a career-day forum.

Public relations may come in the form of letters such as, "Dear Sir: Here is my design of a spaceship . . ."; or working through your own public relations department to arrange speakers for meetings, sending product models for specific technical events; etc.

► An Engineering Job—The "engineering" part of the job is always present. And especially so in performing liaison between the engineering department and engineering personnel.

Here the personnel engineer must keep in close contact with the engineering groups for which he has personnel responsibility. He must meet with engineering supervisors and project engineers to keep close tab on the type of work being done and any critical manpower needs

This might involve a visit to the laboratory, getting briefed on a new facility or new equipment, discussing technical problems, or, perhaps, getting a peek at things to come.

This liaison and gathering of information provides the personnel engineer with a cineramic view of technical activity which few other engineering positions have to offer. He gets behind the "technical curtain" of many engineering groups.

▶ Recruiting Is No Snap—Recruiting trips have a peculiar pattern all their own. If your home office is in the West, you do your recruiting in the East and vice versa.

Also, recruiting trips serve a purpose not too unlike that served by rest camps during a war. It gives the recruiter the opportunity to get away from the home office. Recruiting is no snap by any means, but it does offer a change of scenery which is good. And meeting new people with new stories is stimulating.

A hotel suite is ordinarily the personnel engineer's home away from home. It's here that he sets up his field office, makes all of his contacts and does all of

his interviewing.

An advertisement placed in the local newspaper invites qualified applicants to telephone. If the caller sounds as if he might fit, an interview is arranged. But sometimes the only resemblance between the caller and the applicant who walks into the hotel suite is the person's name.

It's true that the applicant does have the 15 years' experience he claimed on the phone, but that was eight years ago. Since that time he's been selling real estate, used cars and running his aunt's grocery

store.

Once in a while, a harassed mother-in-law may call to inquire about a job for her unemployed son-in-law. Admittedly these two cited cases are unusual, but they're the things that add a little flavor to the recruiting diet.

Ordinarily, the personnel engineer is engaged in sharp intellectual exercise with educated technical men who are being interviewed for job placement. He must be able to understand and exchange verbal communications with them, constantly adjusting his mental sights to get a clear picture of the person he is interviewing. He has to cover and evaluate the applicant's experience, education, social adjustment and personality - all within about an hour's time.

Just as Reader's Digest condenses stories, the personnel engineer condenses the evaluation interview, being skilled enough to pass over nonessentials and to draw out important facts. He must have a good idea of the kind of manpower

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A new alcohol with great reactivity

Do you have a five-carbon alcohol problem? If so, you may find your solution in CARBIDE's highly reactive mixed isomer, primary amyl alcohol.

CARBIDE's primary amyl alcohol consists of approximately 60% pentanol-1, 35% 2-methyl butanol-1 and 5% 3-methyl butanol-1. There are no lower molecular weight molecules, no residual chlorine, and no secondary or tertiary alcohols. That's why it is so ideal where lower volatility, greater reactivity, and increased efficiency are needed.

Primary amyl alcohol is useful as an intermediate for ore flotation reagents, plasticizers, di-ester-type lubricants, fuel and lube oil additives, resin catalysts, vinyl stabilizers, corrosion inhibitors, and surface-active agents. It can be the reaction solvent in preparation of penicillin salts, and a wash in their purification. This mixed isomer also is used as a coupler and latent solvent for nitrocellulose lacquers.

In contrast to secondary alcohols, primary amyl alcohol reacts readily with carbon disulfide and sodium or potassium hydroxide to form primary amyl xanthate . . . a powerful collector for concentrating sulfide minerals containing lead, nickel, zinc, iron, and copper.

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The potential uses of primary amyl alcohol are many. For example—it deserves study for use in preparing esters of 2,4-D and 2,4,5-T herbicides, and as a spreading agent for oil-emulsion insecticides. Oil-soluble primary amyl phosphates and phosphites derived from primary amyl alcohol should be

evaluated as catalysts in resin manufacture. Amines prepared from primary amyl alcohol are corrosion inhibitors, rubbers, agricultural chemicals, and surface-active agents. And, various esters of primary amyl alcohol lend themselves to use in perfumes and flavors.

CARBIDE's primary amyl alcohol is immediately available in tank cars or trucks, and in 55-gallon drums (carload or LCL lots). For more information, check the coupon for Technical Information Bulletin F-8517C.

Tear out this coupon. Check the boxes on which you'd like more information, and mail to Dept. HE, Union Carbide Chemicals Company, 30 East 42nd Street, New York 17, N. Y. ☐ Primary amyl alcohol. F-8517C

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760 mm. Hg	
Freezing Point, °C	90 (sets to glass
Solubility in Water at 20°C., wt. %	1.7
Solubility of Water in at 20°C., wt. %	9.2
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being sought and must be able to recognize experience in other fields or industries that might be transferable to the openings he has to fill.

► Critical Evaluation — Just as important as evaluating whether or not the applicant has what the job demands, the personnel engineer must listen and determine whether or not the job has what the applicant is

looking for.

Often the applicant assumes that the interviewer is in a much better position to judge if the job and applicant fit or misfit. He relies heavily on the personnel engineer's view of the situation. This is an important responsibility since the personnel engineer is instrumental in inducing people to change their lives.

In the laboratory an engineer can experiment and experiment until he finds a solution to a particular problem. You are not allowed this luxury when you deal with people.

At the other end of the line, the engineering supervisor is going to "go" or "no go" on an applicant depending on what the interview report recommends. Companies do differ on this arrangement, but many times the applicant is offered a job, or passed by, based on the one interview he had with a personnel engineer.

► A Rewarding Job—The efforts of the personnel engineer are rewarded in different little ways:

 Getting an "accept" notice telling him that one of his better applicants has accepted the job.

 Being told by a technical supervisor that the last chemical engineer he hired turned out to be a gem.

 Looking up an applicant who has already started on the job and saying hello.

In a sense this is engineering creativity because the personnel engineer has seen his action develop from just so many words during the interview, through translation into phrases on applications and correspondence, to the reality of the man stepping into the job.

► Stay Young-at-Heart — The college campus is the third en-

vironment in which the personnel engineer does his work.

Regardless of chronological age, he must be young-at-heart psychologically to understand and gain the acceptance of new graduates. He should try to share the excitement that the graduate is experiencing in anticipation of that "first big job" and recognize how important the interview becomes to the applicant.

Ordinarily the personnel engineer makes his contacts through the college placement bureau; and he is usually allowed a 30-min. interview with each candidate. This is not very much time to establish rapport, appraise the graduate and then tell him something about the company.

With parameters such as these, the personnel engineer has to have his interview approach honed razor-sharp or else it will be sluggish, rambling and unproductive. The tempo is fast and no sooner does one new graduate leave the interview booth before another eager one arrives.

It's a repeat performance every half hour. The personnel engineer must sometimes have the courage of Daniel stepping into the lion's den to generate the same enthusiasm and interest for his last interview of the day as he did for his first.

Faculty Contacts Too—The personnel engineer's contacts on the campus aren't all confined to students. Ordinarily he has lunch with engineering and science faculty members. Discussions center around the professors appraisals of the particular candidates the personnel engineer has interviewed and also on the engineering programs of the employer.

Surprisingly, most faculty members have a splendid grapevine on your company, what it is doing and the technical problems it faces. This is where it pays off for the personnel engineer to be well informed about what's happening in his own engineering department.

Competition on the campus is getting worse. Only those who sincerely enjoy their work as personnel engineers can do a commendable job without completely draining themselves of all energy.

► Some Fringe Benefits—The campus visit does offer some fringe benefits to the personnel engineer, however.

The halls of ivy, the atmosphere of knowledge, the young adventurous intellects, students' faces showing freedom from life's cares, or complete dejection at not being asked to go for a Coke; all this is an adventure in living which escapes dollar measure. You may also attend a football game or hear a violin concert.

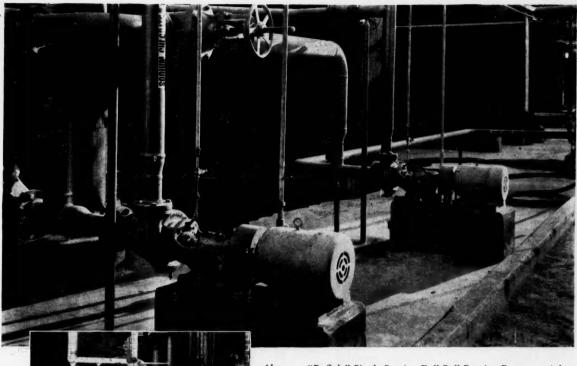
► Companies Differ—This is the job as seen through the eyes of one who is now employed as a personnel engineer.

There are not as many jobs open in personnel engineering as there are in other branches of engineering. In fact, there are probably 50 applicants for every job open. Furthermore, employers are still unsettled as to what qualifications they want in a personnel engineer.

One thing is certain, however, it takes an unusual engineer to be successful in this unusual work. This calls for no ordinary cat, but a new breed: The Personnel Engineer.



R. J. OBROCHTA, 33, has been personnel engineer at Convair (San Diego), a division of General Dynamics Corp. for three years. He is a graduate of Loyola University (Chicago) and holds the M.S. degree in industrial-clinical psychology. He is an evening instructor at San Diego Junior College where he teaches "Psychology for Supervisors." A certified psychologist in the State of California, Obrochta is a member of the American Psychological Assn. and the Human Engineering Society of San Diego. At home he personnel engineers his wife and six children: three boys and three girls.



Above — "Buffalo" Single Suction Full Ball Bearing Pumps, stainless steel construction, handling sodium chlorate.

ORROSION— ONTAMINATION ONTROLLED WITH "BUFFALO" PUMPS

At left — "Buffalo" Single Suction Pumps of stainless steel construction handling hydrogen peroxide bleach.

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CHEMICAL ENGINEERING-October 19, 1959

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OPERATION & MAINTENANCE EDITED BY M. D. ROBBINS





Self-Service Stores—Boon or Bane?

Whether or not to allow free access to low-cost stores items is a point of major contention. Here's a round-up on current industry practice and thinking.

American industry, in 1957, spent a staggering \$14 billion on maintenance. Quite a healthy expense.

In your own plant, maintenance might run as high as 25% of total direct manufacturing costs. And in this sizable chunk, 60-70% of the total maintenance bill might be made up of labor and overhead.

With this sort of breakdown of maintenance costs, it isn't any wonder you should check every facet of cost reduction.

There are numerous places to start but you don't have to look very far in your own plant to notice the daily troop of highpriced craftsmen to and from the storehouse. And then, to boot, the long wait for service. Very simply, the manpower costs involved in materials delivery, location, identification, and attendant overhead, are phenomenal. One sure way to tackle this problem is to inaugurate a materials control program.

Most of this was treated in a recent article (*Chem. Eng.*, Jan. 12, 1959, p. 148) but the storehouse problem, that ties in very closely, hasn't been touched: What to do about the great number of storekeepers and their load of paper work.

► Open Stores Solve a Problem
—One way of getting at your storekeeper and bookkeeping problems is just to do away with them. Let the craftsmen help themselves to necessary mainte-

nance supplies. Naturally, this isn't practical for all supply items.

However, when the Chemstrand plant in Decatur, Ala. analyzed requisitions for individual orders on the plant storeroom, they found, over a measured period of time, the largest number of items ordered were worth less than \$1 each.

They decided to eliminate stores orders for these low-value, high-turnover items. Included in this under \$1.00 category are nuts, bolts, washers, rags, etc. These items are out where everyone can help himself, no requisitions needed.

Chemstrand is convinced this practice doesn't result in any greater consumption of materi-



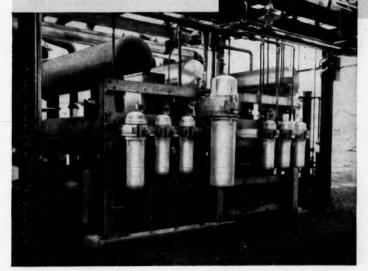
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als and, of course, saves a lot

of bookkeeping.

Manpower Cut 50%—In a similar development, the Air Force's Arnold Engineering Development Center (Tullahoma, Tenn.) keeps a series of storerooms that look more like a five-and-ten-cent store's hardware section than a maintenance storehouse. These are their self-service centers for high-turnover items.

This system, the Air Force claims, saves \$105,000/yr. in

man-hours alone.

As in all open stores systems, the key is the worker himself. He takes what he needs and then makes out a slip telling what he took.

Included in the Air Force system are all parts with a turnover rate of 25% or more. For example: electrical switches, fittings, washers, screws, bolts, photographic supplies, pipes, etc. Stores kept this way have a total value of \$176,000.

Operation is simple: Each day, the storekeepers total up the amount drawn and then refill the bins. Seventeen self-service centers are kept up by 18 storekeepers. Before introducing open stores, it required 39 storekeepers to operate the supply rooms.

Savings of \$105,000 are due to the reduced work force and the large cut in paperwork.

Overdrawing doesn't seem to be a great problem. As strange as it seems, workers now take less than under the old supply system.

▶ Waiting Time Reduced—Out on the West Coast, Stauffer Chemical Co. reports equally good results with a similar system. Their open stores technique has been working for several years at the plant where it was initially tried and is now standard operating procedure at all of their Pacific Coast operations.

Savings they claim, are substantial—a good part coming from fewer storekeepers but, unlike the Air Force, major saving is due to reduced waiting time for mechanics.

"When we first tried it, some six years ago," said M. L. Spealman, Stauffer's Vice-President of Production on the Pacific Coast, "we didn't have someone else's experience to rely on. Justification for the trial at one plant was obvious from looking at the line-up of high-priced mechanics frequently waiting to be served at the storeroom."

Stauffer isn't too sure of their material losses, but are satisfied it's no greater than most systems using written stores orders and clerks to issue materials.

Checks, Spealman says, prove out the system. The two they

use are:

Final maintenance costs.
Use rate of materials as

observed by storekeepers and maintenance supervisors.

► Why Do Paperwork? — Open stores techniques work out particularly well as a short-cut in paperwork. Maintenance Supervisor Ralph Price at Columbia Southern's big Corpus Christi (Tex.) plant calls materials in this operation: give-away items.

What it means is charging out to "General Factory Expense" the low-cost items when received. Later, this expense is distributed to all departments. Effect on job material cost is negligible.

Columbia-Southern currently includes all items with a unit price of \$1.00 or less, purchased in quantities of \$50 or under. Price is now giving some thought to raising this limiting quantity from \$50 to \$100.

Experience shows that half the number of requisitions daily are processed with only 10% of the dollar volume of total stores disbursed. Naturally this has an attendant saving on paperwork.

Special colored tags distinguish the give-away items in

the stores bins.

In the same way, at Dow Chemical Co. in Pittsburgh, Calif., estimated annual savings of \$10,000-\$12,000 are claimed from:

Less processing of purchase requisitions.

 Less time lost by workmen waiting for delivery of small items.

 Time savings in making material take-offs for combination bill-of-material-stores requisitions.

Dow uses small "serve-yourself" stock stations at four or five strategic locations around the plant. Again, no requisitions; hence, the savings outlined above.

Centers contain bread-andbutter items like nuts, bolts, gaskets, washers, black iron pipe fittings, etc. Bins are restocked weekly by storeroom personnel.

Plant Manager Lou Simenson answers the big question succinctly: "Losses are minimal."

All Don't Agree—There are some dissenters in this move toward open stores. Many companies feel there is more of a danger than a saving in such a system. Others just feel there's nothing to be gained.

In San Francisco, Standard Oil Co. of California's (Socal) western operations have overall purchases running close to \$100 million. They don't use open stores with any mainte-

nance items.

At Socal, the purchase and stores department buys items up to \$1.00 in value and then assigns them to the manufacturing department. Each department is charged with accountability for these items. On items over \$1.00, the purchase and stores department buys and accounts for each item.

Socal has looked at the open stores system, but decided there were no advantages to warrant using it. As they put it:

"Since the company is constantly on the lookout for better and more efficient ways to do business, we will keep the method under review but have no intention at present of adopting the idea."

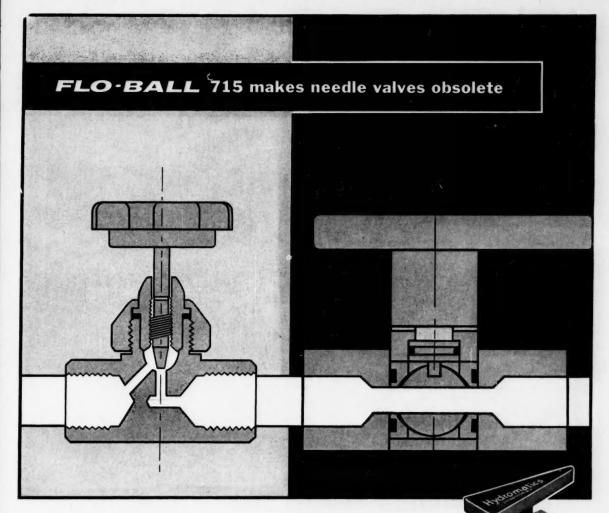
► What Does it all Mean?—The picture painted for an open stores system seems quite rosy but this doesn't mean it's the only and ideal solution to store-

house problems.

You need records. You must analyze the flow of materials and then decide whether such a step as outlined is economically feasible. Unfortunately, many companies don't keep the cost and material records so necessary to set up and evaluate an open stores problem.

First step, then, is to collect data. Only after that can you go ahead and make your decision based on the experience

of other companies.



Which valve has 100% flow efficiency?

100% flow efficiency—an unrestricted straightthru fluid path—is another feature of the Hydromatics FLO•BALL 715, shown on the right. That's more than double the flow efficiency of needle valves. Furthermore, a fast quarter turn moves the FLO•BALL from open to closed position; instant action at flow pressures up to 3,000 psi with just 4 inch-pound torque! And the arrow-shaped handle provides positive on-off indication. Ideal for leakproof control of air, vacuum, steam, water, fuels, oils, kerosene, alcohol, etc., the FLO•BALL features zero leakage, universal mounting, removable flanges, and all stainless steel construction.

Write today for a complete catalog describing this valve and others for corrosive and cryogenic media. Also special designs for throttling flow control.

The FLO-BALL costs no more than old fashioned screw-type valves!

Hydromatics, Inc.

LIVINGSTON, N. J. . WYMAN 2-4900 . TWX = LIVINGSTON, N. J. 120

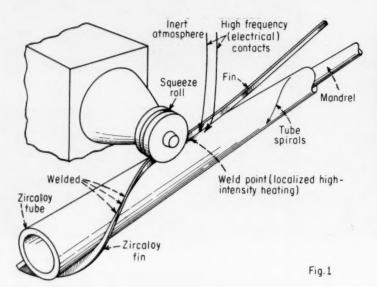
Copyright 1959 Hydromatics, Inc.

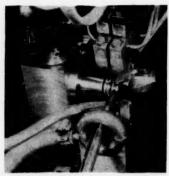
exceptional engineering employment opportunities—write today



PRACTICE ...

CORROSION FORUM EDITED BY R. B. NORDEN





HIGH-FREQUENCY welding (450,000 cycles) equipment permits precise placement of a weld; produces complicated shapes and combinations.

New Welding Methods Join Exotic Metals

High electrical frequencies, electron beams or ultrasonics, by making "impossible" shapes and combinations possible, are revolutionizing the art of joining metals.

Rocket, missile and nuclear technology has opened up a Pandora's box of metal and alloy problems. Only the unusual metals, capable of handling high temperatures or intense atomic radiation, can operate in this league.

But these cranky, reactive, sometimes unpredictable materials are difficult to produce and even more difficult to work with once they are produced. One major problem in working with "space or atomic-age" metals has received a lot of recent atten-

tion: joining, by welding, of materials that react with air. This includes zirconium, titanium, molybdenum and their rapidly multiplying alloys.

The new joining techniques sometimes seem more exotic than the metals themselves. But such methods as high-frequency welding, electron-beam welding and welding with ultrasonic vibrations make possible unique combinations of metals and alloys—many would be impossible with standard fusion or resistance welding.

We are going to make an attempt at giving a general picture of just what these exotic welding techniques are, how they work and what they mean.

► High - Frequency Welding — The idea of causing current to flow across a metal joint, heating it to the melting point and then joining the surfaces is as old as welding itself. But the application of high-frequency current (up to 450,000 cycles), a relatively new adaption of resistance welding, produces some strikingly unique results.



Metal chlorides causing corrosion?

... Test HAYNES Alloys

In recent tests, Hastelloy alloy C resisted corrosive ferric chloride solutions so thoroughly that no weight loss could be measured over a five-day period. Similar results were obtained with cupric chloride. Other tests proved that alloy C is virtually immune to corrosion from sea water. Hastelloy alloy B, another Hannes alloy, offers outstanding resistance under reducing conditions to solutions of magnesium and aluminum chlorides.

What effect do contaminants, temperature, flow rates, and concentration have on this resistance? Why not find out for sure by testing HAYNES alloys under your own process conditions? We'll gladly send you samples. To help us select the alloy most likely to solve your problem, we suggest that you send us a letter outlining the corrosive conditions in your plant. To learn more about HASTELLOY alloys, ask for a copy of our 104-page book.

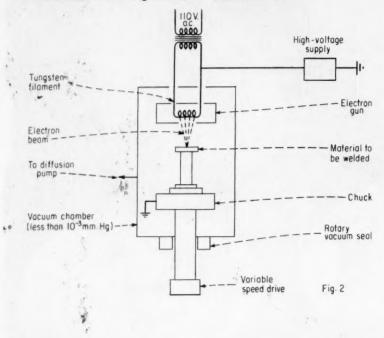


Division of Union Carbide Corporation Kokomo, Indiana



The terms "Haynes," Hastelloy," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Electron-Beam Welding Eliminates Contamination



High-frequency current doesn't follow the direct resistance path on metal, but does follow the long inductance route. This current tends to flow on the metal surface, producing localized high-intensity heating. Some form of mechanical pressure completes the weld. Because of this skin effect, very thin sections can be joined (0.004-in.). You can't do this with usual arc or resistance welding.*

Since heat is localized, the process permits precise placing of a weld with very little weld flash. All sorts of complicated and unusual shapes (see p. 222) and combinations (copper to steel, alloy-steel to carbon steel) can be handled.

► Automatic, Continuous — The procedure is basically a continuous one, well suited to automatic control. Much design work has gone into adapting it to high-speed operations, particularly for the production of tubing (closing the seam). It's known that Alcoa, Republic Steel, Reynolds, Southern Pipe and Casing, United Tube, James Steel and

Tube are all working with highfrequency machines in this coun-

► Exotic Shapes—But high frequency isn't limited to seam welding. Spirally finned tubing for heat exchangers (see p. 222) are in production for atomic reactors. Materials are Zircaloy fins and Zircaloy tubes. The finned tubes are produced on a draw bench in a batch operation.

One producer (New Rochelle Tool Corp.) claims their machine can resistance weld metals ranging in thickness from 0.004 to §-in. at speeds up to 1,000 ft./min. The process works on steel, stainless, aluminum, copper, titanium, zirconium and alloys, and is capable of welding almost any shape you want.

Equipment includes output transformer, control panel, sliding contacts, feed mechanism, squeeze rolls and enclosure for inert gas (when needed).

Actually there are two highfrequency-joining methods—resistance welding and induction welding. Both produce the same results—one involves introducing current by means of sliding elements which come into contact with the metal. The other works through a magnetic flux—electrical elements do not contact the metal.

High-frequency welding involves a heavy capital investment. Electrical equipment alone can run to \$50,000. But a shop induction welder for joining large pipe sections is in use (Chem. Eng., Sept. 22, 1958, p. 96). And the basic technique looks like a natural for producing unusual tubing, piping and equipment combinations for the chemical and petroleum process industries.

► Welding With Electrons — Electron-beam fusion welding, perhaps the most glamorous of the new techniques, is specifically designed to avoid weld contamination.

Just a few years ago electronbeam welding, a close relative to electron-beam melting (*Chem. Eng.*, July 13, 1959, p. 80), was strictly a laboratory baby. It's now commercial.

For many operations, inertgas shielded tungsten-arc methods or inert-gas high-frequency welding are perfectly adequate for zirconium, molybdenum, titanium. However there are impurities in the electrode, on the metal and in the inert gas. These can make a weld brittle or lower its resistance in a severely corrosive environment.

▶ No Contamination — The new method eliminates electrodes and the inert atmosphere. It involves bombarding two pieces to be welded with a beam of electrons in a high-vacuum chamber. This beam, concentrating the weld heat on a very small section, can be carefully controlled to join 0.005-in. thick metal.

Essentially, equipment consists of the following:

- W or Ta cathode to emit a large number of electrons (tungsten spiral wire heated above 2,600 K.).
- High potential (several thousand volts) to accelerate electrons.
- Electrostatic and/or magnetic focusing arrangement to form electrons into a concentrated beam or spot of about \$\frac{1}{6}\$-in. dia.
- A vacuum chamber and pumping equipment to maintain 10⁻² mm. Hg or less.

The higher the voltage poten-

^{*}A new short-arc consumable electrode technique permits manual fusion of 0.030 to 0.100-in.-thick metals.

Put a Teflon® sleeve in the body insert a plug





add a diaphragm,



a gasket



and a thrust

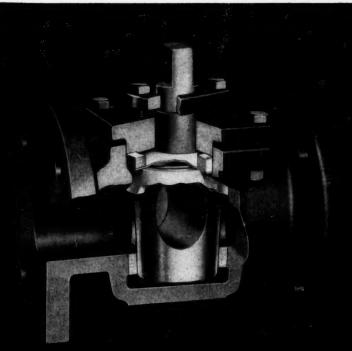
collar, secure the cap and the



self-aligning adjuster,

and you've got a non-lubricated, trouble-free plug valve.

This is the new Type G DURCO SLEEVELINE

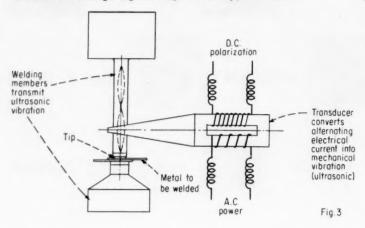


ductile or stainless screwed or flanged 1/2" to 2" sizes

ductile flanged sizes to 6"

150 psi rating write for Bulletin V/12

Ultrasonic Welding: High Strengths, No Applied Heat



tial for the same current, the greater the energy delivered to the weld. Low-voltage (5 to 50 kilovolts) and high-voltage (50 to 100 kilovolts) machines are available.

Most welders made in this country operate between 15 to 30 kilovolts. Expensive shielding against X-rays is necessary above about 30 kilovolts.

▶ Who Makes Welders? — Producers of electron-beam welders are NRC Equipment Corp., Newton, Mass.; Air Reduction, Murray Hill, N. J.; High Vacuum Equipment Corp., Hingham, Mass.; Carl Zeiss (Electrona, Inc., New York, N. Y.); Sciaky Brothers, Inc., Chicago, Ill. (a French machine) and Stauffer-Temescal, Richmond, Calif. Alloyd Research Corp., Watertown, Mass., acts as a consultant on electron-beam welding problems.

Welders produced in this country are in the \$12,000 to \$50,000 range depending on size (the Zeiss high-voltage machine is more expensive but it's available

on a rental basis).

A number of companies including Nuclear Metals, General Electric (Hanford, Wash.), Westinghouse (Bettis Div.), Olin Mathieson and Dow Chemical are working with the welders, mainly in fabrication of nuclear fuel elements. Union Carbide has a NRC welder at Oak Ridge; Sylvania Corning is working with a High Vacuum machine.

Westinghouse is using a Zeiss

machine capable of operating at 100 kilovolts. The high voltage makes deep penetrations of 0.25-in. possible along with depth/width ratios above 2/1. Low voltages give deep penetrations but depth/width ratios are about 3/2—however, electron-beams produce 2 to 4 times the penetration of tungsten arc for the same power input.

But in many cases high penetration ratios are not required. And low-voltage machines have welded Zircaloy-2, aluminum and stainless-clad fuel elements. Copper, gold, nickel, silver, platinum, uranium, aluminum, beryllium, aluminum to steel, molybdenum, titanium and magnesium have been joined with electron beams (mainly flatwork, although machines are available for more complicated pieces).

► Weld With Vibrations—Ultrasonic welding—a radically different approach to metal joining is a method of bonding thin sections of similar and dissimilar metals. Energy is high-intensity, high-frequency vibrations.

The big selling points for ultrasonic welding:

 There is no applied heat; union is accomplished through a "solid-state" bond.

 Surface preparation of the metal is not critical.

Very slight metal deformation.

 No arc, spark or smoke contamination.
 Metals joined include aluminum, magnesium, stainless steel, copper, brass, titanium, zirconium, beryllium.

The process works very well on fine wire and thin strips. Thickness of at least one of the members must be in the range of 0.0015 to 0.040 in.* So foil-thick metals can be joined to heavy plates, rods or tubes. And there is no difficulty in joining dissimilar metals (gold-platinum alloy welded to nickel).

►Strong Bond — Pieces to be joined are clamped at low pressure between two welding members or sonotrodes and vibration introduced for about 0.01 to 1 sec. The result is a very strong solid-state metallurgical bond.

Welding (spot or seam) system consists of two major elements:

• A transducer which converts alternating electric current into mechanical vibration. This is usually a stack of nickel laminations each 10 mils thick.

• A coupling, usually metal members, which conducts mechanical vibration from the transducer to the work area.

Actually, ultrasonic welding is not a heatless process. The intense vibration does cause a temperature rise. Temperatures, however, are below the melting point of the metals in the weld, and there doesn't seem to be any molten fusion.

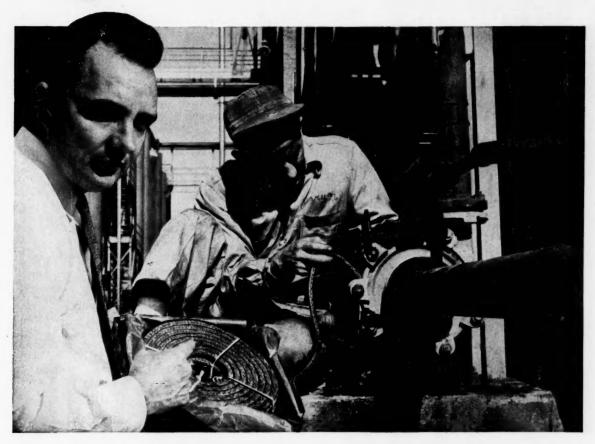
► Commercial Equipment — So far the only commercial equipment on the market is made by Aeroprojects, Inc., West Chester, Pa. Westinghouse works with equipment of its own design.

An ultrasonic machine costs between \$2,000 and \$32,000. From an economic standpoint, ultrasonic welders can't compete with usual fusion welders on ferrous materials. Its applications appear to be on the "difficult" materials, bimetals and thin sections.

Alcoa uses a production welder to join aluminum foil (high-speed seam welding). Kaiser Aluminum is doing experimental work on aluminum. And ultrasonic welders are used extensively in the manufacture of transistors (heat-fusion welding causes all type of troubles, particularly from gas evolution).

^{* 0.10-}in. thick aluminum sections have been ultrasonically joined.





"We tested one packing after another... but only 'U.S.' could stand up,"

Says CHEMICAL PLANT SUPERINTENDENT

When a leading mid-western chemical company put their new plant into operation in 1955, they faced a problem with pump packings: To find a packing resistant to a combination of solvents, caustic and high temperature—with a minimum of shaft wear.

"We tested one packing after another on our caustic pumps," says the plant superintendent, "and found that U. S. Solvent Packing outlasted any other packing tested by as much as 10 to 1."

Result: No more morale-breaking "clean-up" sessions,

production is increased, personal injuries due to leaks have been reduced 75%, and there's no need for rescheduling due to breakdowns.

A "U.S." technician, of course, worked with engineers of the chemical company to develop the right packing for this particular requirement. That's part of the "U.S." service, when needed.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.



Mechanical Goods Division

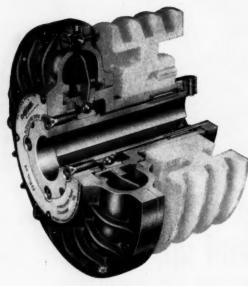
United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y.

In Canada: Dominion Rubber Company, Ltd.

WHAT'S YOUR PROBLEM?...



HOW FLEXIDYNE WORKS



The "dry fluid" in Flexidyne is tiny heat-treated steel shot. A measured amount, called the "flow charge," is contained in the housing, which is keyed to the motor shaft. Inside the housing is a rotor, free to revolve relative to the housing, but connected to the load.

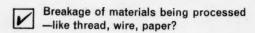
When the motor is started, centrifugal

between the housing and the rotor, which transmits power to the load. Initial slippage is momentary. Housing and rotor become locked together and achieve full load speed without slip and at 100% efficiency.

CALL THE TRANSMISSIONEER — your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the white pages of your telephone directory for "Dodge Transmissioneer."







Expense of oversize or high torque motors?

High demand rate?

Expense of reduced voltage starters?

Clutch trouble?

Breakage of transmission parts due to instantaneous shock loads?

Damage and recurring down-time from overloads?

FLEXIDYNE

THE DRY FLUID DRIVE

It is no longer necessary to accept the destructiveness—the costliness-of conventional starting in the mechanical transmission of power. Flexidyne changes that!

Flexidyne is the new way to start loads smoothly-to protect against shock and overload-to save power-all without any sacrifice of efficiency at full load!

This revolutionary development is ushering in "the day of the soft start"-which can mean thousands of dollars to you in equipment savings and in better, more economical operation.

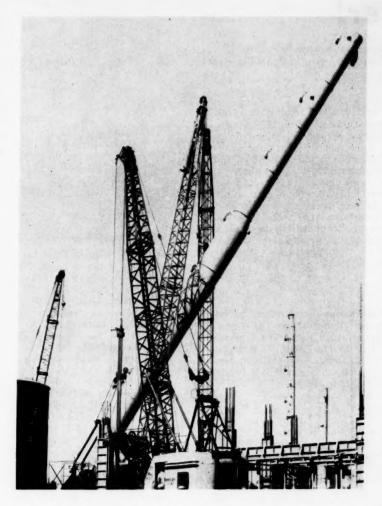
Flexidyne is available, off the shelf, in Drives and Couplings. Capacities range from fractional to 1,000 hp. Ask your local Dodge Distributor or write us for technical bulletin.

DODGE MANUFACTURING CORPORATION, 200 Union St., Mishawaka, Ind.



FIRMS IN THE NEWS

NEW FACILITIES



Badger Engineers Erect This Sky-Reaching Column

Sohio Chemical Co.'s new acrylonitrile plant at Lima, Ohio, now abuilding, will go on stream early next year. Plant will make first use of a new process, featuring single-step conversion of refinery propylene and anhydrous ammonia to acrylonitrile. Badger Manufacturing Co., engineering and construction contractor, reports that construction is now on schedule, should be completed early next year.

Alabama Metallurgical Corp. has begun test operations at its new 7,000-ton/yr. magnesium plant at Selma, Ala. New \$3.5-million plant engineered and constructed by Walter L. Couse & Co. of Detroit, Mich.

Scientific Design is engineering Monsanto Chemical Co.'s 10,000-ton/yr., maleic anhy-





TOROUE-ARM

America's most widely used shaft mounted speed reducers!



DODGE PARA-FLEX

The Flexible Cushion Coupling with the 4-way flex!



DIAMOND D CLUTCHES

Rugged! Compact! Completely enclosed!

Write for Bulletins!

- ✔ Torque-Arm—55 models—complete data.
- ✔ Para-flex Couplings—data.
- 1 Diamond D Clutches-technical data.

DODGE MANUFACTURING CORPORATION 200 Union Street • Mishawaka, Indiana



FLEXFLYTE-TFE

stays on the job longer!

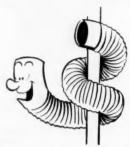
Here's the ideal replacement for hoses and tubes to 12" diameter that fail under tough chemical handling conditions.



Flexflyte-TFE tubing is lined with DuPont Teflon* TFE-fluorocarbon resins. This means it has a liner that is impervious to industrial acids and caustics; will not become sticky; cannot be dissolved; reduces contamination; and has zero water absorption. To reinforce this liner, the construction includes a galvanized steel wire helix and woven fiber glass cloth impregnated and coated, depending on temperature requirements, with neoprene or silicone.



Continuous service can be expected from Flexflyte-TFE in the temperature range from minus 100°F to plus 500°F. It is highly flexible, light in weight, and construction can be modified to handle pressures to 400 psig.



Installation is simple. Flexflyte-TFE can be bent around machinery components without kinking. And cuffed ends permit easy attachment to outlets and fittings.

*A DuPont trademark

 $\frac{1}{2}$ " to 12" diameters in lengths to 12 ft.—except $\frac{1}{2}$ " to $\frac{1}{8}$ " diameters—available to 6 ft. lengths only.

Flexible Tubing

CORPORATION

GUILFORD, CONNECTICUT

ANAHEIM, CALIFORNIA

HILLSIDE, ILLINOIS

FIRMS . . .

dride expansion at St. Louis, Mo. Capacity increase will boost Monsanto's maleic output potential to 30,000 tons/ yr.



Reichhold Chemicals, Inc. schedules completion of its new 15,000-ton/yr. phthalic anhydride plant at Elizabeth, N. J. New facility, costing \$5-million and designed by Badger, is shown above.

Cleaver-Brooks Special Products, Inc. of Waukesha, Wis., is designing and fabricating equipment for a 100,000-gal./day sea-water distillation pilot plant, now abuilding at Oxnard, Calif. Test operations are scheduled for next month, to prove out the multiple-stage, flash-evaporation process.

Valley Nitrogen Producer's Cooperative just placed on stream a 150-ton/day anhydrous ammonia plant at Helm, Calif. Valley Nitrogen also plans to construct ammonium sulfate, ammonium phosphate and phosphoric acid facilities.

Rayonier Canada, Ltd. announces plans for construction of a 250-ton/day bleached kraft pulp mill at Woodfibre, B. C. Rayonier has dropped its old name, Alaska Pine & Cellulose, Ltd.

Stauffer Chemical Co. announces plans for construc-



PRE-REGISTER YOUR PROCESSING PROBLEMS AT THE SPROUT-WALDRON SCHOOL OF ADAPTIONEERING

If you plan to be at the Chemical Exposition in New York next month, it will pay you to preregister your processing problems with our research staff. As a special service to those who plan to attend, we have set up an expediting unit to review, analyze and report on all pre-registered problems in time for further confidential discussion at the Show. Use the convenient form below or send us the details on your letterhead. All problems will be researched in order of receipt. No obligation, of course.

MATERIAL(S):	# 1	# 2	# 3
Name			
Chemical Formula			
Bulk Density (lbs./cu. ft.)			
Moisture (%H ₂ O)			
Melting or Softening Point (°F.)			
Toxic (yes or no)			
Feed Temperature			
Particle Size (mesh distribution)			
Other			-

THE PROBLEM: (Include capacity, distances, elbows in system, etc.)

DEOL	JESTED	DV.
KEWL	<i>,</i> E3 EL	DI:

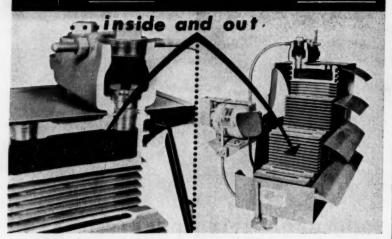
 STOP BY AND SEE US AT BOOTHS 846-848



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Size Classification • Mixing and Blending Bulk Materials Handling • Pelleting and Densifying

it's the material that makes the difference



CORROSION - Inside and Out - causes heating equipment failures! BUT NOT WHEN YOU USE

CAST ITON CONSTRUCTION | BLAST HEATERS

UNIT HEATERS **RADIATORS**

CORROSION internally, caused by electrolytic action as in copper tubes, can't happen in GRID's cast iron steam chambers and headers. Nor can acid condensate corrode the bottom connections. Cast iron, internally, resists corrosion.

CORROSION externally. caused by acid fumes cannot destroy GRID's cast iron finned heating surface. Widely spaced fins cast integral with the steam chamber will not corrode externally.

Send for Catalog 956 . . . The complete story on Grid Unit Heaters, Blast Heaters and Radiators

Designed for operation on steam pressure up to 250 PSI 450° temperature

INSTALL

UNIT HEATERS BLAST HEATERS

RADIATORS

CAST IRON







vailable in Horizontol and Wide range of sizes furnish-bown Blow madels. All cast ed with or without pressure ron built for steam pres- blowers. Compact cast iron ures up to 250 PSI 450 design requires less space.

Various combinations with or without Grill covers. For use in confined areas where motorized units are not de-sirable. For low or high

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Manufacturers Since 1883

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WAUSAU, WISCONSIN

FIRMS . . .

tion of a new liquid-alum plant at Vernon, Calif., and a new research center at Stanford University. Rising demands for alum by the pulp and paper and water-purification industries spurred the construction of the 12,000ton/yr. alum plant.

Thiokol Chemical Corp. reveals expanded U.S. Army manufacturing and testing facilities for medium and large rocket engines at the Marshal, Tex., Longhorn Ordnance Works. Production and testing facilities are operated by Thiokol.



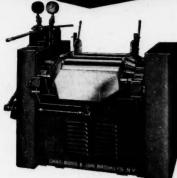
Beetle Plastics Corporation, subsidiary of Crompton & Knowles Corporation, went into full-scale production of fiberglass-reinforced plastics at Fall River, Mass. Shown above are fabrication facilities, where radar domes and chemical storage tanks are manufactured.

Firestone Tire and Rubber Co. announces plans for the construction of a synthetic-fiber plant at a newly acquired site in Hopewell, Va. First fiber to be produced will be nylon, for tire cords.

U.S. Atomic Energy Commission has contracted Roberson Construction Co. of Columbia, S. C., to construct and install four 1.3-million-gal. tanks for radioactive waste storage. Each tank will be constructed of steel, encased in concrete and buried underground.

Sylvania Electric Products, Inc. has begun construction of a

HIGH SPEED THREE ROLL MILLS WITH



- Pressure indicating gauges provide greater ease in properly setting rolls, and less skill or experience is required by operator.
- Roll pressure settings can be recorded for exact reproduction of material assuring standardization of product.
- Special equalizers assure positive parallelism roll faces at all times for uniform dispersions d minimum maintenance costs.
- Mills have quick roll release with safety over-load feature, and are convertible for either fixed or floating center roll operation. 2½x5, 4½x10, 6x14, 5x24, 12x30, 14x32, and 16x40" sizes.

Production size dispersion type Change Can Mixers with-DOUBLE PLANETARY stirrer action.



with special blade angles and very close clearances revolve on their own axis and also around can, developing 12 intense compressive and shearing actions with each revolution to break down and disperse arglemerates. agglomerates.

agglomerates.

• Variable speed for infinite range of stirrer speed control.

• Simplified vertical hydraulic lift for greatest ease in cleaning down stirrers.

• Non-revolving can is completely enclosed during mixing for safety and to reduce solvent loss. Cans can be jacketed or fitted with slide gate when required. Cans are easily positioned or removed from Mixer.

• Extra heavy construction and standard type motor eliminate costly downtime. Oversized motor drives can be provided for keeading and mixing extremely heavy materials. 1, 2, 3, 4, 6, 8, 12, 25, 50, 65, 85, 125 and 150 gallon sizes.

125 and 150 gallon sizes. Area of can contacted by stir-rers during only one revolution of stirrers around can (2 sec-onds). Position of stirrers ad-vances 4½° with each succes-sive revolution to sweep entire area and all points on sides of can. Stirrers overlap each other as well as center of can.

Write for further information!

CHARLES ROSS & SON COMPANY, INC. 150 Classon Avenue Brooklyn 5, N. Y., U. S. A.

It's a fact. HEAVY-DUTY ENGINES IN ALLIS-CHALMERS LIFT TRUCKS SAVE YOU MORE AKE YOU MORE



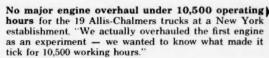
The heavy-duty industrial engines in Allis-Chalmers lift trucks stand alone in their ability to take tough work for long periods. The fact that they are the most rugged used in lift trucks means thousands of extra work hours, minimum maintenance, more years of service.

The fact that they deliver more usable horsepower means they do extra work every hour - maneuver faster, climb steeper grades. An Allis-Chalmers 2,000-lb truck, for instance, climbs a 40-percent grade loaded — other makes in the same class climb grades of only 18 to 28 percent.

Does the engine make a difference? Just listen to these users.



"They're brutes for punishment," comments a spokesman for a Michigan firm. "We formerly replaced an engine a year - haven't replaced any in the Allis-Chalmers trucks in over three years of operation.'





"They use less fuel than other trucks do," says a chief mechanic in Wisconsin. "Allis-Chalmers lift trucks also are tougher than others and require less maintenance.

Put an Allis-Chalmers lift truck to work and you will see many advantages of its heavy-duty engine immediately. But it will take years to reveal all the benefits. Let your dealer give you more facts - and a demonstration. Allis-Chalmers, Milwaukee 1, Wisconsin.





Still going strong in the sulphite pulp mill of Eastern Fine Paper and Pulp Division, Standard Packaging Corp., at South Brewer, Maine, is the Aloyco Stainless Steel "Y" valve, above.

This, and other Aloyco Valves were purchased in 1933 when the hot acid system was installed here. They have been in continuous use ever since.

Long trouble free service is the reason so many U.S. plants are turning to stainless steel and high alloy valves... even for mild corrosive service.

Only one company has specialized in corrosion-resistant valves exclusively for 30 years: Alloy Steel Products Co. Call us in on your next valve job. Write us at 1301 West Elizabeth Ave.



ALLOY STEEL PRODUCTS COMPANY Linden, New Jersey

FIRMS . . .

facility for fabrication of tungsten and molybdenum for rocket and missile applications at Towanda, Pa. Sylvania Chemical and Metallurgical divisions will supply the tungsten and molybdenum metal powders for fabrication.

Pittsburgh Plate Glass Co. discloses plans for construction of a 18,750-ton/yr. fiber glass yarn plant at Shelby, N. C. Original plans called for construction of 12,500-ton/yr. plant.

Leeds & Northrup Co., manufacturer of process control instruments, has just dedicated a new \$2-million research facility at North Wales, Pa. Leeds & Northrup will thus consolidate its research efforts, now conducted in scattered companies in the Philadelphia area.

Aluminum Co. of America announces plans for expansion of its Wenatchee, Wash., reduction works. Included in the expansion plans are two 50,000-lb., hot-metal holding furnaces and pig-casting machinery.



Standard Oil of Indiana has acquired True's Oil Co. of Spokane, Wash., a marketer of petroleum products in the Northwest. Thus Standard Oil plans to increase its sales in that area.

Humble Oil and Refining Co. and Standard Oil Co. of New Jersey, have just merged. New corporation, to bear the name of Humble, and to be registered in Delaware, will consolidate all producing, refining, marketing and marine operations of Standard Oil.

Atlantic Research Corp. of Alexandria, Va. announces the

G-B ULTRALITE DISTRIBUTORS

(See ad on facing page)

(See ad on facing page)

AKRON, Ohio, The Asbestos Supply Co.
ALBANY, Ga., Industry Insulation Co.
ALBANY, N. Y., Hudson Valley Asbestos Corp.
ALBANY, N. Y., Hudson Valley Asbestos Corp.
ALBANY, N. Y., Hudson Valley Asbestos Corp.
ALBANG, N. W., Hudson Valley Asbestos Corp.
ALBANGR, M. M. M. States Insulating Co.
ALLANTA, &a., Reynolds Aluminum Supply Co.
BALTIMORE, Md., Leroy Insulation Co.
BANGOR, Me., Eastern Glass Co.
BEALMONT, Tex., Solar Supply Co.
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CHARLESTON HEIMITS, S. C., Stafford Insulation Co.
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HOUSTON, Tex., Precision Insulation Co.

HOUSTON, Tex., Precision Insulation Co.

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KEWANEE, III., Mechanical Insulation Co., Inc.

LAKE GHARLES, La., Soisr Supply Co.

LUBBOCK, Tex., Mechanical Equipment Co.

LOUSVILLE, Ky., General Insulation Co., Inc.

LAKE GHARLES, La., Soisr Supply Co.

MACON, Ga., Industry Insulation Co.

MEMPHIS, Tenn., John A. Denie's Sons, Co.

Gibbons Supply Co.

MACON, Ga., Industry Insulation Co.

MINNEAPOLIS, Minn., Abestos Products Co.

MILWAUKEE, Wisc., F. R. Dengel Co.

MILWAUKEE, Wisc., F. R. Dengel Co.

MINNEAPOLIS, Minn., Asbestos Products, Inc.

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NEW ORLEAMS, La, Eagle Asbestos & Packing Co.

OMANAN, N. Y., Eastern Steam Specialty Co.

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PHILADELPHIA, Pa., John F. Scanian, Inc.

POORTIAND, Me., Eastern Steam Specialty Co.

OMANANE, Conn., Insulation Supply Co.

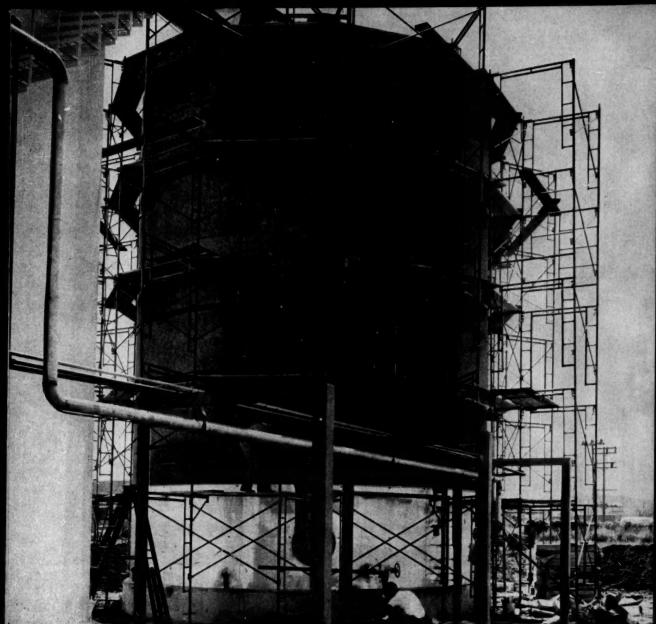
ORANGE, Conn., Insulation Supply Co.

ORANGE, Conn., Insulation Supply Co.

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SAN PARCONCO, Western Fibrous Glass Products Co.

SAN P



Insulation Contractor: Central Insulation & Engineering Co., Kansas City, Mo.

It was
insulated
in just
12 man-hours
with
ULTRALITE®

For information and prompt delivery, call your local ULTRALITE distributor listed in adjoining column.

There's nothing like ULTRALITE® glass fiber insulation

to save time and money when you insulate tanks, vats or vessels. A case in point: this chemical tank job, involving 3 workmen, was started in the morning . . . completely insulated with ULTRALITE by noon . . . and covered with aluminum jacketing by quitting time. The insulation contractor estimates that the customer saved at least 50% by wrapping the tank with ULTRALITE instead of using rigid block-like materials.

ULTRALITE blankets—available in widths up to 10 feet and thicknesses up to 6"—provide thermal protection that is permanent and outstanding ("K" is .27 at 70° F. mean). For complete details on how to "wrap your tanks and reap the savings," write today or call your nearby G-B distributor listed in the adjoining column.

Gustin-Bacon

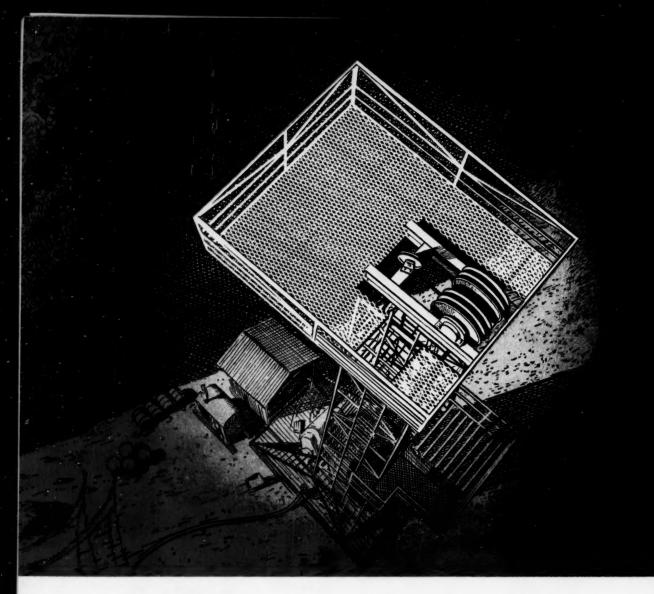
AGUN Manufacturing Ca



252 WEST 10TH ST.,

KANSAS CITY, MO.

Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation Couplings and fittings for plain and grooved end pipe



RIGHT...from the top down

A good, dependable water supply system is no better than its beginning. The best beginning is a Layne drilled water well. Layne is the largest water well drilling organization in the world with over 75 years experience. Trained crews operate over 500 drilling and service rigs throughout the country.

Layne service doesn't stop there. A dependable Layne Pump specially designed for the job to deliver a specified

QUANTITY of water, and Layne water treatment service to supply the exact QUALITY of water desired, are part of a complete job with undivided responsibility. But, that's not all. Layne maintenance and repair service wraps up the complete package. Your nearby Layne Company is as close as your telephone, so, call on Layne for a dependable water supply, right . . . from the top down, all backed by Layne Research.

LAYNE & BOWLER, INC., MEMPHIS

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WATER WELLS • VERTICAL TURBINE PUMPS • WATER TREATMENT



WELL DRILLING



ASSOCIATE COMPANIES

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INTERNATIONAL WATER CORPORATION

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LAYNE-WESTERN COMPANY

Kansas City, Missouri St. Louis, Missouri Aurora, Illinois Ames, Iowa Omaha, Nebraska Wichita, Kansas Denver, Colorado

CANADA

INTERNATIONAL WATER SUPPLY, LTD.

London, Ontario, Canada Oakville, Ontario, Canada Montreal, Quebec, Canada Quebec, Quebec, Canada Saskatoon, Saskatchewan, Canada Vancouver, B.C., Canada . . . FIRMS

Acquisition of the latter intin Co. of Los Angeles, Calif., manufacturer of precision process equipment. Atlantic Research thus augments its strength in the rocket and missile industry.

Thompson Ramo Wooldridge, Inc., has acquired a controlling interest in Magnetic Recording Industries of New York, N. Y., thus strengthens its position as a supplier of instruments and controls for the missile industry.

W. R. Grace & Co. announces the acquisition of two companies: Endura Corp. of Quakertown, Pa. and Vellumoid Co. of Worcester, Mass. The former produces adhesive materials, while the latter manufactures gaskets.

Brown Fintube Co. is extending its overseas operations, has now established licensees in Canada, England, France and Germany. Foreign firms, producing Brown's products are: Brown Fintube, (Canada) Ltd.; Brown Fintube (Great Britain), Ltd.; Freidrich Uhde, GMBH in West Germany; and Petro-Fouga in France.

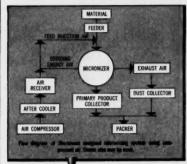
American Marietta announces the acquisition of two concrete companies: Dewey Portland Cement Co. of Kansas City, Mo. and Concrete Materials & Construction Co. of Cedar Rapids, Iowa. Acquisition of the latter includes purchase of an associated firm, Concrete Materials Co.

OVERSEAS BRIEFS

England's Titan Products, Ltd. announces broad expansions to cost a total of \$39-million. Major portion of the program will be devoted to construction of a 20,000-ton/yr. titanium dioxide plant in Canada.

Need 1/2 to 44 Microns?

Sturtevant Micronizers*
Make 325 Mesh Obsolete



One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from ½ to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model (15 in. chamber)

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size.

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 200 Clayton St., Boston, Mass.



*REGISTERED TRADEMARK OF STURTEVANT MILL CO.

NEW SOLUTION to problems of

HANDLING FREE-FLOWING MATERIALS

PNEUMATIC CONVEYORS

Compact, rugged, constant-volume conveying systems eliminate costly complex installations. Unique, selfcontained packaged units available in stationary and portable models for in-plant or outside applications.



Special Daffin volumetric feeder maintains constant material uniformity in transit. Daffinaire positive air-volume with automatic pressure control assures maximum efficiency. One-way (pressure) or two-way (vacuum-pressure) systems. Write for ideas . . . Daffin engineering and laboratory facilities are ready to help solve your problems.

AVAILABLE IN STAINLESS STEEL AND OTHER ALLOYS.







MANUFACTURING COMPANY

3551 NORTH PRINCE STREET,

LANCASTER, PENNSYLVANIA



FIRMS . . .

Other titanium dioxide plants will be built in India, Australia, South Africa and at Grimsby, England.

Switzerland: Reichhold Chemie A. G. is constructing a phthalic anhydride plant at Hausen bei Brugg. New 10,-000-ton/yr. plant to cost \$2.5million is scheduled for completion by early 1960.

Africa: Shell Co. of East Africa, Ltd. has contracted with Kenya for construction of a \$36-million refinery at Mombasa, Kenya. New refinery, to be completed in 1963, will have a capacity of 1.4 million tons/yr. of fuel oil, kerosene, gas oil and diesel fuel.

Dominican Republic: Colgate Palmolive Co. has begun production of soaps, dentifrice paste and other consumer products at its plant at Ciudad, Trujillo. New Caribbean facilities cost close to \$500,-000.

Italy: Independent natural gas producers in the Po valley, have formed a company to operate a new methane processing plant at Adria, near Rovigo. New facility will cost \$750,000.



Strahman Valves, Inc., manufacturer of valves, mixing units, nozzles and level gages, is moving from New York, N. Y., to a new location in Florham Park, N. J. Relocation is tied to a broad expansion program; new site will provide more space for manufacturing.

Hodag Chemical Corp. has moved its production, control and office facilities to a new location in Chicago, Ill. Included in new facilities is a sonic homogenizer for silicone antifoam manufacture.

Accurate Flow Control of Viscous Fluids



... apply heat uniformly throughout the valve from flange to flange and up to the stuffing box. Product viscosity is easily maintained at minimum levels for maximum control accuracy. Sluggish valve action is eliminated as there are no unjacketed areas for cold slugs to form. Smooth surfaces and large sweeping contours of the internal body allow product movement through the valve with low friction losses.



Valve will operate in response to control air from any standard 3-15 % range pneumatic controller. Diaphragm operators for 6-30 % ranges are available.

Trim is stainless steel—plugs and seats can be hard-faced for resistance to wear from abrasive products. Standard packing is Teflon with or without lubrication.

Bodies are semisteel, Ductile Iron, steel or stainless steel to suit application.

Sizes range from $1\frac{1}{4}$ " to 4". Larger sizes on application.

For complete details and dimensions write for supplement catalog

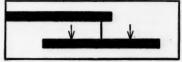




How did this team solve an age-old weighing problem?

Since 5,000 B.C. men have been trying to devise a pivot balance that would be highly sensistive yet remain accurate. The breakthrough came in 1956 when the United States issued a patent for a "Thayer Flexure Plate" Leverage System. A team of engineers and businessmen, aware of industrys great cumulative loss of materials in weighing operations, had invented a revolutionary new scale.

Knife-edged pivots that progressively wear and change were replaced by



Thayer Flexure Plates that move only .001", yet accurately reflect the minutest changes in weight. This firmly joined lever withstands shocks and vibrations indefinitely. Dirt and dust are no longer a problem. Thayer guarantees this leverage system accurate for the life of the scale.

How Can It Save You Money Year After Year?

Working in conjunction with straight electrical controls, it forms the most reliable, low maintenance system ever devised to control processing or materials handling by weight. Literature on its application to filling, batching and checkweighing operations is available on request.



THAYER SCALE

AUTOWEIGHTION SYSTEMS FOR FILLING, BATCHING AND CHECKWEIGHING

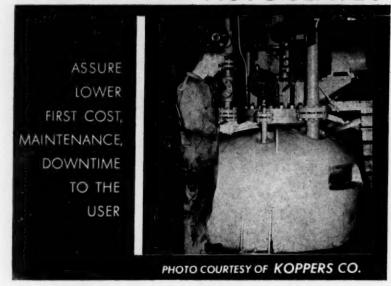
THAYER SCALE CORP.

THAYER PARK,

PEMBROKE, MASS.

WHY

BETHLEHEM AGITATED AUTOCLAVES



Bethlehem's seven decades of experience, and manufacturing facilities should be investigated by you before purchasing autoclaves either jacketed or not for any temperature or pressure.

Full advantage of every material of construction used whether it be mild steel, stainless steel, monel, carpenter 20 or clad—is taken by using ASME code accepted methods such as stress relieving, X-ray, etc.

Downtime and maintenance is reduced by sturdy design of drive and agitator.

For information relating to our autoclaves, kettles, pan and horizontal dryers (continuous and batch), reactors, and chemical castings, write for our 8-page brochure. No obligation.

For Better Chemical Processing Equipment consider Bethlehem's Experience.

BETHLEHEM FOUNDRY & MACHINE CO.

4 PLAZA SQUARE

BETHLEHEM, PENNSYLVANIA

CALENDAR

- American Coke & Coal Chemicals Inst., annual meeting, Greenbrier. Oct. 19-20 White Sulfur Springs, W. Va.
- American Standards Assn., national meeting, Sheraton Hotel. Oct. 21-23 French Lick, Ind.
- National Lubricating Grease Institute, annual meeting, Roosevelt Hotel. Oct. 26-28 New Orleans, La.
- Independent Petroleum Assn. of America, annual meeting, Statler Hilton Hotel. Oct. 26-27 Dallas, Tex.
- American Institute of Chemical Engineers, New York Section, annual symposium, Hotel New Yorker. Oct. 27 New York, N. Y.
- Assn. of Consulting and Chemical Engineers, annual symposium and banquet, Sheraton-McAlpin Hotel. Oct. 27 New York, N. Y.
- Society of Aircraft Materials and Process Engineers, Sealant and Sealing Symposium, Institute of Aeronautical Sciences Building. Oct. 28-30 Los Angeles, Calif.
- Armour Research Foundation, annual computer conference, Morrison Hotel.
 Oct. 28-29 Chicago, Ill.
- American Institute of Chemical Engineers, South Texas Section, annual technical meeting, Moody Center. Oct. 30 Galveston, Tex.
- Canadian Chemical Specialties
 Manufacturers Assn., annual
 meeting and convention, Royal
 York Hotel.
 Nov. 2-4 Toronto, Ont.
- Atomic Industrial Forum, annual meeting, Sheraton-Park Hotel. Nov. 2-3 Washington, D. C.
- Metallurgical Society, American Institute of Mining, Metallurgical and Petroleum Engineers, National Metals Congress, Morrison Hotel. Nov. 2-5 Chicago, Ill.
- American Society for Metals, annual meeting and congress, International Amphitheatre. Nov. 2-6 Chicago, Ill.
- Industrial Management Society, Industrial Engineering and Management Clinic, Hotel Sherman. Nov. 4-6 Chicago, Ill.
- American Nuclear Society, national meeting, Sheraton Park Hotel. Nov. 4-6 Washington, D. C.
- Technical Assn. of the Pulp and Paper Industry, Alkaline Paper Conference, Robert Meyer Hotel.

 Nov. 4-6 Jacksonville, Fla.
- Eighth Annual Instrumentation Conference, Louisiana Polytechnic Institute. Nov. 5-6 Rushton, La.
- Chemical Market Research Assn., meeting on consumer chemicals. Nov. 9-10 Chicago, Ill.

I.S.I. CHEMICAL

Sodium Alcoholates Act as Catalysts for Formation of Graft Polymers by Milling

Government researchers reported recently that graft polymers can be prepared by milling the component resins together on an ordinary roll mill with an anionic catalyst such as a sodium alcoholate. The reactants need not be solubilized, since reaction takes place right

So far, styrene has been grafted onto polybutadiene and onto a copolymer of butadiene and acrylonitrile by this process. In a typical preparation, polybutadiene is milled with dispersed sodium until the mixture reaches 60°C. After cooling the rolls to 20°C., styrene is added, then propinol. Cooling stops and polymerization begins.

Temperature control is of the greatest importance to the success of the reaction. Too much heat causes gel formation; too little yields polystyrene. The researchers report that stabilizers need not be removed from the resins since they do not interfere with the grafting process. Resins can therefore be stored until used. No inert atmosphere is nec-

Information on the preparation of sodium dispersions and their use as polymerization catalysts generally, as well as their use for sodium alcoholate preparation, is contained in U.S.I.'s brochure on Sodium Dispersions. This brochure may be obtained on request.

n-Butyl Alcohol Data Sheet Just Issued by U.S.I.

n-Butyl alcohol - solvent for coatings and resins and intermediate for plasticizers, resins, weed killers, ore flotation agents and many other compounds - is described in a new technical data sheet now available from

Specifications, properties, shipping and application information are included. The advantages of the material as a solvent for nitrocellulose lacquers are highlighted.

The data sheet can be obtained from U.S.I. sales offices or from the Industrial Alcohol and Solvents Sales Department at 99 Park Avenue in New York.

Ether Aerosol Gives **Diesels Quick Start**

Ethyl ether and a lubricant have been combined in an aerosol formulation designed to permit quick starting of diesel engines in cold weather.

The formulation, recently put on the market in pressurized cans, is said to be low in cost and to perform at temperatures down to minus 60°F. Advantages cited for this priming fuel include: reduced dilution and wear, minimizing of strain on engine parts and batteries, prevention of downtime, elimination of towing and extra labor costs.

New Uses Developing Rapidly For Polyethylene Film in **Chemical Plant Construction**

Film Makes Ideal Moisture Barrier for Buildings and Roads; Protects Construction Machinery, Equipment and Materials.

The ready availability of low-cost polyethylene film in a wide range of widths, lengths and thicknesses is changing the face of the construction industry. New building practices and techniques are evolving rapidly to take advantage of the excellent moisture barrier characteristics,

New Analysis for Naphthas **Uses Gas Chromatography**

At the ACS meeting at Atlantic City in September, it was reported that a shortened analysis for olefin-free naphthas has been developed. Gas chromatographic methods, using ethyl chloride as an internal standard, is said to give the content of C5 and lighter components in these naphthas in one-third the time formerly required by standard low-temperature fractional distillation (LTFD)

The naphtha sample, blended with ethyl chloride, is injected onto Silicone 200 on a column of Celite. The technique involves reversing the flow of the helium carrier gas after n-pentane has come off, to backflush the heavier components from the column.

In addition to the time-saving aspects of the new method, it is claimed to give outstanding reproducibility as well as improved accuracy over the LTFD method.

Because of its flexibility, strength and light weight, polyethylene film has proved

Another great advantage in construction work is the durability of polyethylene film. It has great toughness and elasticity and will take considerable abuse without tearing. It stays flexible under all types of weather conditions.

Film Valuable in Concrete Work

Constructors of chemical plants, commercial buildings, homes and other structures are employing polyethylene film for three general types of jobs: in concrete work; as a vapor barrier for interiors; as a protective covering.

As a curing agent for concrete slabs, poly ethylene film laid over the watered, hardened concrete retards evaporation and allows the slab to age slowly, giving maximum hardness. The sheet can then be used again, either for the same type of job, or under a foundation slab or concrete road section as a moisture barrier base.

MORE



Polyethylene tarpaulin being placed over building materials during plant construction.

October

U.S.I. CHEMICAL NEWS

1959

CONTINUED

Polyethylene Film

easy to handle in concrete work, and cuts down on tearing, which has been a problem with many other materials.

New Use in Tilt-Up Construction

In tilt-up slab concrete construction, polyethylene film is being used as a bond-breaking barrier. A layer of film is laid on the surface on which the slab will be poured, to separate it from that surface. After drying, the poured slab can be tilted up from the surface quickly and easily. Its undersurface is smooth, and it has received a strong, even cure because of the moisture barrier characteristics of the film.

In the pouring of foundation walls, polyethylene film is being employed to line the forms for smooth finish and better curing. It is then attached to the walls before backfilling, to act as a moisture barrier for the completed foundation.

Polyethylene film acts as an excellent moisture barrier on side walls and ceilings, in the water-proofing of beams, in the flashing of stone and brick sills, for flashing window and door heads in masonry construction—in short, for all types of moisture-proofing work on buildings.

Film Protects Work and Personnel

Finally, chemical constructors find that polyethylene film gives excellent protection from the weather — for men, structures, equipment, machinery and materials. On unfinished buildings, it keeps out wind and dirt while permitting the sun's light and heat to enter. Work can continue, uninterrupted by cold or storm. And as a tarpaulin, polyethylene film is light and easy to handle — provides the most inexpensive protection available for expensive equipment.

The future of polyethylene in the building industry continues to be brightened by new applications. For example, "bubble houses" held up by air pressure show promise as economical shelters for construction work or temporary storage. New uses such as these promise to further the spectacular growth which has been characteristic of polyethylene in recent years.

Another New UV Absorber Developed for Polyethylene

A metal-organic stabilizer has been developed to protect polyethylene film, sueet and monofilaments against deterioration from ultraviolet action during outdoor exposure. It is claimed that a two- to five-fold increase in the useful life of the finished product can be obtained through incorporation of this stabilizer into the resin.

The compatability of the product with polyethylene and its high thermal stability are said to make it suitable for low-gauge films where, because of the high ratio of surface area to volume, conventional UV absorbers are not too effective.

As little as 0.25% of the product has been found to give effective stabilization. However, 0.5% is generally recommended. At these concentrations, the very slight green color imparted is reported to be negligible, particularly in low-gauge stock. The material is also recommended for use with polyolefins other than polyethylene.

The following typical weathering data is given for conventional polyethylene:

Percent Elongation Versus Hours of Accelerated Weathering*

Carl III	Hours of Exposure		
Stabilizer Concentration, %	0	150	250
0.0 (unmilled sample)	545	105	26
0.0 (milled sample)**	388	86	0
0.2 (milled sample)	400	366	175
0.5 (milled sample) **	262	247	252
		CONTRACTOR OF THE PARTY OF THE	10000

*Accelerated weathering conducted in Fade-O-Meter.

Five-mil. extruded film used for tests.

**Standard procedure includes 10-minute milling of resin and additive, at or near mult temperature of respective resins, on 2-rall plastics mill, to insure complete dispersion.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

New, all-inorganic zinc coating is designed to give high galvanic protection and to eliminate sub-film rusting in fresh and salt water, solvents. Claimed effective from —80°F to +750°F. Can be used as single coat or as prime coat.

Handbook on properties of rare earth metals and compounds is now being sold. Brings together for first time current data on physical, crystal, chemical, mechanical, electrical, magnetic, nuclear and thermodynamic properties of the 15 rare earth metals plus yttrium.

No. 1521

Electron beam welding process has been developed for zirconium, hafnium, tantalum and other reactive metals impossible or very dificult to weld by ordinary means. Uses high intensity beam in high vacuum.

No. 1522

Fact file on titanium and titanium alloys can now be obtained. Booklet contains sections on high temperature performance, corrosion and erosion resistance, properties, metallurgy, machining, fabrication, welding and testing. No. 1523

New use for molecular sieves—to both store and tame a large number of chemical compounds which are extremely volatile, toxic or reactive—is described in a booklet now available on chemical-loaded molecular sieves.

No. 1524

Phospho and silico molybdic acids are now being produced in experimental quantities. Suggested for use in analyses and in petro-hemical and pigment fields, as catalysts, organic precipitants and corrosion inhibitors. No. 1525

An atomic industry directory of products, equipment and services can now be purchased. Gives product and service profiles of over 200 industrial organizations active in development and use of atomic energy here and abroad.

No. 1526

Colorimetric unit for quick-testing of low concentrations of dissolved oxygen in boiler feedwater is now on market. Claimed accurate to within two parts per billion of oxygen. Said to be easy to use by inexperienced operators.

Tetranitromethane oxidizer for high-energy liquid and solid rocket and missile fuel systems is described in new data sheet. Active oxygen content is close to liquid oxygen while formulation of stable, storable fuels is easier.

No. 1528

New pH calculator, set up like a slide rule, solves complex problems involving concentration of buffer solutions, rapidly and easily. Eliminates logarithm calcuations with scales that can be read to second decimal place.

No. 1529

PRODUCTS OF U.S.I.

POLYETHYLENE RESINS

PETROTHENE® Polyothylone Resins
Top grade resins for film extrusion, paper coating, electrical wire and cable coating, calendering, injection molding, blow molding and thermoforming.

CHEMICALS

Organic Solvents and Intermediates: Normal Butyl Alcohol, Amyl Alcohol, Fusel Oil, Ethyl Acetate, Normal Butyl Acetate, Diethyl Carbonate, DIATO(®), Diethyl Oxalate, Ethyl Ether, Acetane, Acetacetanilide, Acetacet-Ortho-Chioranilide, Acetacet-Ortho-Chioranilide, Ethyl Acetacet-Ortho-Chioranilide, Ethyl Acetacet-Ortho-Chioranilide, Ethyl Representate, Ethyl Chioraformate, Ethylene, Ethyl

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Alcohols: Ethyl (pure and all denatured formulas): Anhydrous and Regular Proprietary Denatured Alcohol Solvents SOLOX®, FILMEX®, ANSOL® M, ANSOL PR.

Animal Feed Products: Antibiotic Feed Supplements, Calcium Pantothenate, Choline Chloride, Special Liquid CURBAY, Menadione (Vitamin K₃), D1-Methionine, MOREA® Premix, Riboflavin Products, U.S.I. Permadry, Vitamin B₁₂ Feed Supplements, Vitamin D₃.

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Spring loaded packing



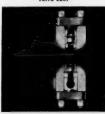
Packing adjusting screw style stuffing box



Poppet Valve, stainless steel



Ball valve, hardened inserted valve seat



Rall valve removable seats

Gaulin Triplex Pumps Increase Your Pumping Capacity, Extend Your Pumping Pressures...

Reduce Operating and Maintenance Costs, Too!

Gaulin Horizontal Triplex Pumps handle large volume of all types and densities of fluids. Rugged, compact and dependable, they provide long service life at minimum maintenance costs in transfer, metering and spray drying applications.

Horizontal Design provides well area separating product from crank case.

Well Area can be gasketed for maintaining sterility... or for inert compatible chemicals (gases or liquid) for hazardous materials.

Gaulin Cylinder can be disassembled in minutes. Capacities from 50 to 6500 GPH . . . pressures from 500 to 12,000 psi.

Write for Bulletin P-55. At the same time ask for GTA... Gaulin Technical Assistance... for experienced advice and factual data on the best method to move or blend your product.



World's largest manufacturer of stainless steel reciprocating, rotary, pressure exchange pumps, dispersers, homogenizers and colloid mills.

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WEINMAN

split case pumps

There are seemingly endless varieties of applications for Weinman Type SB, single stage, double suction pumps. They're ideal for any low head, small capacity liquid handling job.

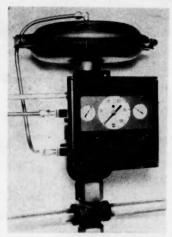
Purchase price is surprisingly low. In addition, operating costs are rock bottom, too. The horizontally split case design simplifies maintenance. If necessary, the active rotating element can be removed without disturbing piping, connections, fittings or driver. Type SB pumps are regularly furnished in cast iron with bronze fittings, but are available in other metals or special alloys for severe conditions.



NEW EQUIPMENT . . .

(Continued from p. 130) horizontal plane as the shaft centerline, vertical shaft movement is minimized, eliminating the compensations usually required for support of conventional foot-mounted turbines.

Each of the new single-stage, mechanical drive turbines is also adaptable to natural-gas expansion, and to other gases such as Freon.—Dean Hill Pump, Indianapolis, Ind. 130E



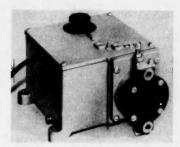
Positioner-Controller

Two-in-one instrument decreases maintenance costs.

Claimed to be the first of its kind on the market, the new Pilot-Positioner combines the functions of two instruments. First, it acts as an indicating pneumatic controller for temperature or pressure. Secondly, it amplifies air pressure to provide accurate and rapid positioning of an air-operated control valve.

Valve manufacturers can mount Pilot-Positioner on most makes of diaphragm motor valves, or on certain other types of pneumatic operators. The unit requires only one air supply—this feature gives rise to installation and maintenance savings. Transmission lags are small, and precision and speed of positioning are high.

Pressure elements cover the range of 30 in. Hg vacuum to 10,000 psi. Filled-system thermal elements cover -350 to 1,000 F.—U.S. Gauge Div., American Machine and Metals, Inc., Sellersville, Pa. 244A

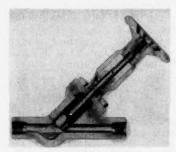


Metering Pump

Diaphragm unit will not distort flow rate.

Developed for positive-displacement metering of a wide range of corrosive and noncorrosive liquids, a new pump satisfies requirements of high accuracy and low-flow metering. Four flow ranges provide outputs up to the maximum of 2.5 gph.

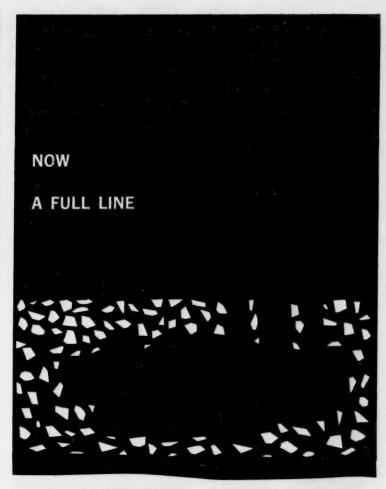
Materials of construction include plastics, stainless steel, nickel, etc. Operating mechanism is totally enclosed and completely submerged in oil. Construction includes a built-in over-pressure relief valve. Maximum output pressure is 500 psi.—CC Pump Div., Clark-Cooper Co., Palmyra, N. J. 245A



Control Valve

Straight - through design cuts friction loss.

Fluids move in a direct and unrestricted straight line through the new Straight-Flow control valve at all throttling



Now — for manufacture of high grade abrasive and ceramic products, Kaiser Chemicals offers you two grades of calcined alumina: KC-1 and KC-2. These are high-purity, uniform quality aluminas, both available in coarse and fine particle sizes.

And for manufacture of electrical and electronic grade ceramics—where superior dielectric properties over a wide temperature range are required—Kaiser Chemicals now offers grades KC-10 and KC-14. These are high-purity aluminas produced with very low soda content.

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Fe ₂ O ₃	0.02	0.02	0.02	0.02
TiO ₂	0.002	0.002	0.002	0.002
Na ₂ O	0.60	0.50	0.10	0.04
Loss on			*	
ignition	0.70	0.10	0.15	0.15
Al ₂ O ₃ (by				
difference)	98.658	99.36	99.5	99.6

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"I don't care if it does do the trick in your attic!"



Highest pumping efficiency, with faultless corrosion resist-ance. Hard rubber casing and impeller; Hastelloy C shaft. 80 gpm. Bul. CE-55.

Fire the bucket brigade!

No time for passing the bucket when corrosion threatens. With one

quick decision you put an end to 85 to 100% of these problems. Just

specify Ace chemical-resistant plas-

tic piping and rubber-protected equipment. The long-term cost is a

drop in the bucket. American Hard

Rubber Company's 108 years of experience is at your service.



Liquids never touch metal in Ace diaphragm valves! Rubber or plastic-lined cast iron, or solid plastic bodies. Sizes ½ to 6". Ask for



All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. Free Bul. CE-56.



High-impact, rubber-plastic, most economi-cal for average chemicals, 1/2 to 6". Screw or solvent welded fit-tings. Valves ½ to 2". NSFapproved. Bul. 80A.

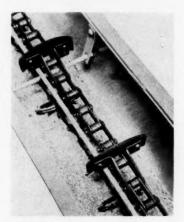
processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY DIVISION OF AMERACE CORPORATION Ace Road • Butler, New Jersey

positions. As such, the valve has an ability to pass more fluids for a given pressure, and with less turbulence. In typical applications, installation of a Straight-Flow unit has increased over-all capacity as much as 20%.

Since flow concentrates in a triangle-shaped orifice instead of in an annular ring, the valve allows passage of much larger solid particles at any given setting. This characteristic prevents clogging.

Sizes run from 1 to 4 in.; pressures to 10,000 psi.-General-American Valve Co., Corona del Mar, Calif.

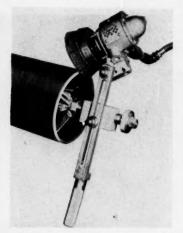


Flight Conveyor

Cleaning action prevents intergrade contamination.

Flite-Flo, a new flight conveyor that is fully enclosed and self-cleaning, can readily move free-flowing, granular, abrasive bulk material in horizontal or limited-incline paths. Each unit consists of a single strand of combination chain carrying spaced flights, operating within a covered U-trough.

Flexible, nonmetallic materials stiffened by steel plates, which are bolted to chain attachments, form the flights. The flights match trough contour to insure effective cleaning action and to prevent contamination when handling several different materials successively in the same unit. Numerous drive arrangements are offered.-Link-Belt Co., Chicago, Ill. 246A



Pipe Beveller

Air-driven machine speeds field welding jobs.

Bev-L-Grinder can accurately bevel 6- to 18-in. pipe in preparation for field welding. The grinder's head locks at angles of 20, 37½ and 90 deg.

Cutting action is fast and easy to control—the operator simply rotates the head around a self-centering spindle. Power source is a 6,000-rpm. air motor.—The E. H. Wachs Co., Chicago, Ill 247A



Pelletize-Mix Disks

For continuous agglomeration or mixing operations.

Laboratory tests and field installations indicate that a standard line of pelletizing-mixing disks develop a given homogeneity of mixture with significantly less retention time

Life in these excited states...



Troubles coming in waves? Try Ace-Ite pipe

Ace-Ite Plastic Pipe...a tough, chemical-resistant ABS rubber-resin blend... is the surest way to stem the tide of corrosion. One of eight types of Ace pipe, it's ideal for general use, handles most chemicals. It's been around long enough so we know what it'll do. And you'll like the price. Ask for Bulletin CE-80.

Design assistance and facilities for molding special fittings, pump parts, etc., of plastics or hard rubber. Also large handfabricating facilities.



Ace chemicalresistant rubberlined steel pipe best for highpressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".



Highly efficient WE pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.



Variety and quality to match any plastic piping. Riviclor PVC, Ace-Ite rubber-plastic, Parian poly, Ace Saran, Tempron high temperature nitrile, hard rubber-lined steel.

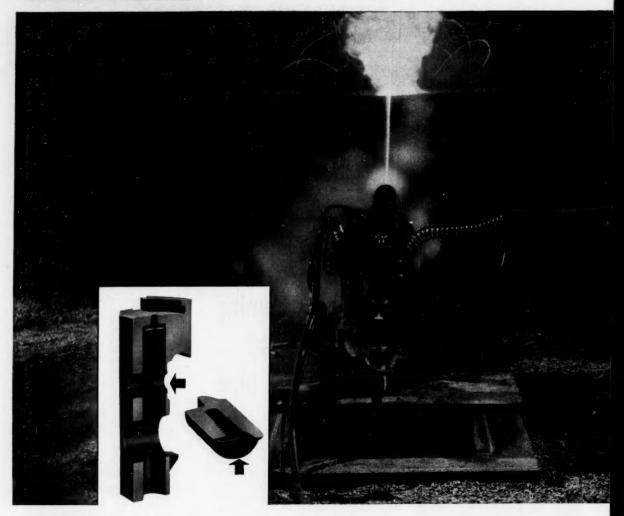


ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
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THE RAW MATERIALS OF PROGRESS



KEL-F° PLASTIC HELPS TRIGGER FASTEST

6000 rounds per minute! That's the sting of the Vulcan-new 20mm aircraft cannon produced at the General Electric Company's Missile Production Section, Burlington, Vermont, with a big assist from 3M KEL-F Brand Halofluorocarbon Polymers.

Vulcan is electrically fired. Hence, its bolt and pin must be insulated. KEL-F Plastic met the rigid criteria for the firing pin liners because it is oil-resistant, has extremely favorable high-temperature properties, including a low coefficient of expansion. KEL-F Plastic was specified for these reasons, and also because it is easy to mold.

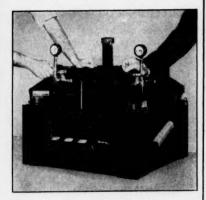
The plastic gates through two small orifices . . . must meet tolerances as close as .001"—an extremely difficult molding job made easier by KEL-F Plastic's moldability. Yet, the KEL-F Plastic liners (see arrows in inset) perform well under the exacting specifications demanded, the extreme temperature ranges encountered. Liners molded by G-W Plastic Engineers, Inc., Bethel, Vermont.

When tough insulation problems have you up in the air, remember KEL-F Polymers. They are finding increasing use in missiles, rockets and aircraft applications. Their performance characteristics are yours for the asking.

CHEMICAL DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY
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80% WEIGHT REDUCTION achieved with 3M Fluorochemicals. Airborne electronics equipment produced by The Martin Company is now protected from internally generated heat with 3M inert fluids.

The result—a cut in weight to less than 200 pounds from the former weight of more than half a ton. In addition, the new equipment outperforms the old under extremes of temperature, altitude and aircraft speed.

3M inert fluids are non-explosive, noncorrosive, non-toxic and odorless. They are ideal as evaporative coolant and insulators.

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See what 3M Chemicals can do for you! For free literature, write on your company letterhead, specifying product interest, to 3M Chemical Division, Dept. KAL-109, St. Paul 6, Minnesota.

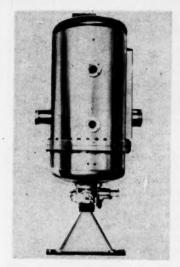
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Waxes and Greases • Dispersion Coatings
• Functional Fluorochemicals • Surfactants
and Inert Liquids

NEW EQUIPMENT . . .

than conventional batch or continuous mixers. The disks are equally effective for pelletizing operations.

Fines feed onto the disk where they contact water or waste liquor sprays. A rolling action pelletizes the fine material and automatically classifies the pellets. The product is uniform in size and relatively strong.

Developed by Lurgi Co. of Frankfurt, Germany, the disks are being manufactured and sold in this country under an exclusive license agreement. Sizes vary from 3.25 to 16.5 ft. in diameter.— Dravo Corp., Pittsburgh, Pa. 247B

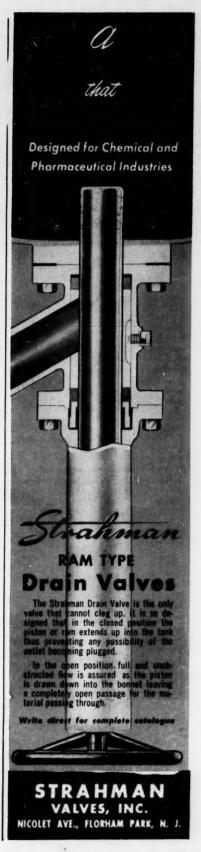


Electron Accelerator

Industrial model added to manufacturer's line.

Especially suited for irradiation of thin plastic films, synthetic fibers or gaseous and liquid chemical reactions, the new Dynamitron electron accelerator provides an output, which at 100% efficiency, will process 6,000 megarad-lb./hr. Scan widths up to 36 in. are available.

This newest member of the manufacturer's line is distinguished by its high beam current, low cost per kilowatt output and basic reliability. Model EA-K 500 is 3 ft. in diameter by 6 ft. long, excluding the beam



WATER IS VITAL to your job and future!

The demand for industrial water will all but double in the next 18 years. With 40% of our communities now facing water shortage problems, approximately two of every five persons will be directly affected at work.

Magazine Editors Voice Concern... Chemical Engineering featured the water shortage problem in their December 1957 issue: Plant Engineering ran a feature on water conservation in February 1958; Chemical & Engineering News in their March 24, 1958, issue headlined a feature story, Needed: An Extra 250 Billion Gallons of Water a Day by 1975. In May, 1958, Water Works Engineering had a story entitled, There Is Enough Water — if We Conserve It! It was followed by another article, For Lack of Enough Water, Industries Can Be Lost. Chemical Engineering Progress in January 1958, covered one phase of conservation in their Water Reservoir Evaporation Control.

In its September 29, 1958 issue, **Steel** asked, *Water*, *Water Everywhere?* and came up with the answer, "No!" It forecasts the expense of industrial water will more than double by 1975.

American City in its January, 1959 issue started a survey of Modern Water Rates. Here are a few of the rates charged per 1000 gallons for large volume users: Ames, lowa — 42¢; Blytheville, Ark. — 13¢; Brunswick, Ga. — 11½¢; Buhl, Idaho — 6¢; Dowagiac, Mich. — 9½¢; Hemet, Calif. — 12¢; Houlton, Maine — 10½¢; Jackson, Tenn. — 12¢; Laconia, N. H. — 13¢; North Andover, Mass. — 17¢.

The above rates are based on the minimum charge made for water and do not include any of the extras that may apply in the city cited. For example, some areas charge extra for customer-owned fire hydrants, fire lines, and sprinkler heads. Thus, a normal plant in these

areas will actually pay more for their water than the minimum rate shown above. Also, all rates are on a sliding scale, so the average rate will be slightly higher than that indicated.

Industry Must Face the Facts...

By 1975, the chances are good that more than 20% of capital investment in a plant will be spent on water. Included in this estimate are: source development, delivery, treatment, piping and waste disposal. Already the mythical rate of 10¢ per 1000 gallons, which Industry considers a maximum charge, is a thing of the past.

...Recirculation Offers Many Advantages

Possibly the most promising way of keeping your water costs down is through recirculation. Many plants have turned to this method for numerous reasons:

- a. Total water used sharply reduced.
- b. Waste must be cleaned up before discharging, so there's little additional treatment required for re-use.
- c. Heat formerly lost is reclaimed.
- d. Less lost-production time due to water failure.
- e. Makes for good community and area relations.
- f. Provides a ready supply of water for fire service under emergency conditions.
- g. Reclaimed waste can often be developed into a valuable by-product.
- h. Maintenance of water cooled heat exchangers sharply reduced.

Filters are becoming more and more important as components of a modern plant's water system. If you feel you would like to discuss or study your own plant's water problem with a member of the R. P. Adams Company, Inc., organization, write us today, at 207 E. Park Drive, Buffalo 17, N. Y.

CONSERVE WATER, OUR MOST VALUABLE NATURAL RESOURCE

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We have a problem involving liqu	0-59 uid filtration. Ask your local representative to call on us.
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Company	
Street	
City	State

NEW EQUIPMENT . . .

extension system. Double as well as single scan configurations are offered.—Radiation Dynamics, Westbury, N. Y. 249A

BRIEFS

Pipeline cleaner, a system using ultrasonic vibration to prevent buildup of sediment on the inside wall of piping, consists of a self-propelled generator and a series of quick coupling transducers. The transducers, when attached to the pipeline, introduce the high-frequency sound waves throughout the system.— Narda Ultrasonic Corp., Westbury, N. Y. 250A

Slotted trays provide continuous support for instrument piping, multitube and control cables. According to the manufacturer, the trays are strong and inexpensive, and permit dropping-out of tubing and cables anywhere in the run. Galvanized steel or aluminum in construction.—
P-W Industries, Inc., Philadelphia, Pa. 250B

Compressors driven by gas engines feature heavy-duty construction and turbocharging. This redesigned line is built in four-, five-, six-, and eight-cylinder models with ratings from 600 to 1,320 bhp.—Clark Bros. Co., Olean, N. Y. 250C

Heavy-duty silicon rectifiers for industrial application are offered in 400- through 2,000-kw. ratings. Standard sizes carry 100% continuous loads, 125% current loads for 2 hr., or 200% for 1 min. Design assures immediate isolation of a faulted cell without interruption of power output.

—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 250D

Spur-gear drive for heavy-duty applications of the manufacturer's Rota-Rake clarifier and thickener has a completely enclosed, integral gearing arrangement. Maintenance consists of infrequent oil changes and a regreasing about once every 5 yr. Designated Model C, the unit joins

three other drives offered for use with the Rota-Rake.— Graver Water Conditioning Co., New York, N. Y. 250E

Transistorized instrument converts motion output from all of the manufacturer's flow, pressure, temperature and level primaries to electrical signals compatible with all miniature electronic instruments. The new transmitter is suitable for operation in ambient temperatures from -20 to 150 F.—Fischer & Porter Co., Hatboro, Pa. 251A

Cartridge filter removes small quantities of solids from low viscosity liquids and gases. When the cartridge becomes plugged, manual or automatic washings remove solids, which flow into a small scavenger unit. Sizes to several hundred square feet.—
T. Shriver & Co. Inc., Harrison, N. J.

Laboratory Versator will homogenize, disperse or emulsify and simultaneously deaerate, defoam or dehydrate thin or viscous fluids. Capacity varies to 2 gpm.—The Cornell Machine Co., New York. N. Y. 251C

Equipment Cost Indexes . . .

	March	June
	1959	1959
Industry		
Avg. of all	232.6	234.3
Process Industries		
Cement mfg	225.8	227.9
Chemical	233.7	235.7
Clay Products	219.4	221.5
Glass mfg	220.7	222.5
Paint mfg	224.4	226.6
Paper mfg	225.2	227.1
Petroleum ind	229.2	231.4
Rubber ind	232.0	234.3
Process ind. avg	230.1	232.8
Related Industries		
Elec. power equip	236.5	246.7
Mining, milling	235.2	237.1
Refrigerating	262.2	264.7
Steam power	219.7	221.8

Compiled quarterly by Marshall and Stevens, Inc., of Chicago, III., for 47 different industries. See Chem. Eng., Nov. 124—6 for method of obtaining index numbers; Feb. 23, 1959, pp: 149-50 for annual averages since 1913.



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Steady filtration **FULLY AUTOMATED**

NIAGARA Filters are available in completely automated models for production-line filtration. Operating with process streams from 5 to over 1,000 gallons per minute, these highly efficient, versatile filters adapt easily to automatic processing of many materials



Speedy cake removal, elimination of manual cloth washing and totally enclosed construction are NIAGARA advantages which arehelping save time and improve product quality in all areas of the processing industry. For more complete data, see NIAGARA'S section in Chemical Engineering Catalog or write:

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TECHNICAL



For theory . . .

The Why & How

PROCESSING OF THERMO-PLASTIC MATERIALS. Edited by E. C. Bernhardt. Reinhold Publishing Corp., New York. 690 pages. \$18.

Reviewed by Allan L. Carbide Griff, Union Co., Plastics Brook, N. J.

This is a highly technical text and reference book for people in the plastics production and fabrication industries. Its value is proportional to the care with which it is read, and it can have very great value indeed.

It is a collection of articles by various authorities in both industry and education-primarily from the technical staffs of the large raw material manufacturers. These articles deal first with fundamentals (for example, flow behavior, heat transfer), and then with methods of fabricating plastics (for example, extrusion, injection molding. welding). The articles are generally written more accurately and thoroughly than simply; they are not to be skimmed

BOOKSHELF

J. B. BACON



. . . and practice

of Plastics

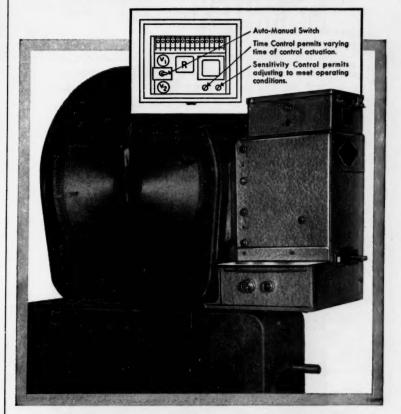
through to get quick answers, but should rather be studied to understand and anticipate problems, and possibly prevent them from occurring in the first place.

Many articles, notably extrusion and all the fundamentals chapters, are heavy with mathematics, including a goodly amount of calculus. The editor and half of his contributors have doctoral degrees, which indicates the level of writing.

Despite the concern with theory, the book is intended to be of practical value, including, for example, a chart to solve molding problems, and considerable processing data (viscosities, shear properties, etc.) for all kinds of thermoplastics. The authors are usually more interested in explaining why things happen than reporting specific results of their know-how. This makes the book valuable for a longer time.

A good use for the book might be for comprehensive study of pertinent portions by all new technical employees of plastic firms (fabricators as well as material suppliers) upon starting

NEW Fairbanks-Morse Electronic Weight Detector



Prevents incorrect weighing . . . stops costly errors!

With the new Electronic Weight Detector, true weight of any load can be automatically obtained and recorded without need of a weighman. Where a weighman is used, it is impossible for him to record incorrect weights or start a sequence at the wrong time. When desired, a flip of the switch can disengage the Weight Detector entirely from the system. This is the first fully-reliable control of its

kind available in the scale industry.

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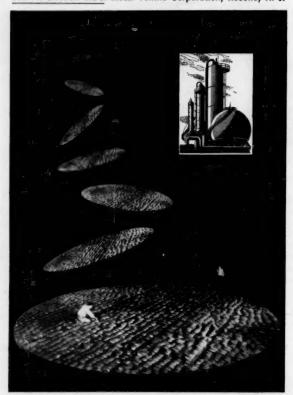
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work—preferably including "labwork" and discussion periods.

Commercial pressures often prevent our plastics technical personnel from studying anvthing carefully and slowly. This book should provide a good reason to deviate from this philosophy, and should be made accessible to all plastics engineers. Furthermore, the chapters pertinent to one's fields of work should be studied by all who claim to have the necessary education background (Engineering or Science degree), no matter how painful or slow this study might be.

It is not so important to be able to memorize and repeat the principles and theories in this book. It is rather more useful to understand them, so that they may be further discussed and developed, and applied to our daily work—making plastics fabrication more a science than an art.

BRIEFLY NOTED

SIGNIFICANCE OF WASTE HEAT RE-COVERY METHODS TO THE GAS IN-DUSTRY. Order Dept., American Gas Assn., 420 Lewington Ave., New York 17, N. Y. \$3. Report summarizes heat-recovery equipment now in use, goes into design of equipment for smaller applications, suggests some economies to be gained by recovering waste

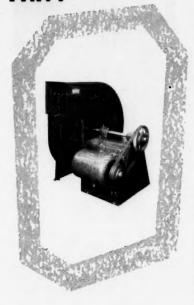
CONVERSION FACTORS AND TECHNICAL DATA FOR THE FOOD INDUSTRY, 6th ed. 1,426 pp. Compiled by C. G. Harrel and R. J. Thelen, Pillsbury Co. Burgess Publishing Co., Minneapolis, Minn. \$20. Contains conversion factors, composition of foods and measurement equivalents in addition to general subject matter such as definitions and standards of identity for foods and ingredients and plant location factors.

MORE NEW BOOKS

CHEMICAL ENGINEERING CALCULA-TIONS. By Ernest J. Henley and Herman Bieber. McGraw-Hill. \$9.

Progress in Vacuum Science and Technology. Edited by A. S. D. Barrett. Pergamon. \$10.

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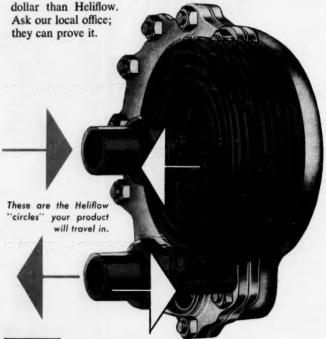
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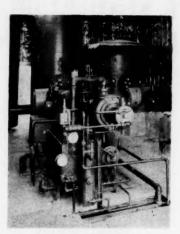


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LETTERS:



Pro: Hydrogen Credit

Sir:

Please refer to the article, "Small-Volume Pure Hydrogen at Bulk Cost," appearing in your Aug. 10 issue (pp. 60-62).

The Van de Mark plant at Linden, N. J., described in your article was designed, engineered and built by R. B. MacMullin Associates. This plant was completed and in operation in May.

Your article makes no mention of our firm, and the reader must infer that the plant was designed by Chemical Design, Inc., Lockport, N. Y., which corporation did not come into existence until July 1, 1959.

Ownership of the process and titles to any patents that may be issued to James R. Meyer (a former partner of our firm) have not been settled nor even negotiated.

R. B. MACMULLIN R. B. MacMullin Associates Niagara Falls, N. Y.

Sir:

Under the agreements between R. B. MacMullin Associates and Van De Mark Chemical Co. during the period the MacMullin firm was retained by Van De Mark, any patents issuing therefrom are clearly the sole property of Van De Mark Chemical Co. Mr. MacMullin has advised us that his firm will abide by this agreement.

PRO & CON

C. H. CHILTON

Van De Mark Chemical has further stipulated that Chemical Design, Inc., shall have exclusive rights under these patents.

ALLAN W. VAN DE MARK Van De Mark Chemical Co. Lockport, N. Y.

The Van De Mark hydrogen plant at Linden is one of many gas purification plants that James R. Meyer, president of Chemical Design, has designed using processes based on lowtemperature experience obtained prior to affiliation with any of the interested parties. This plant was contracted for, designed, erected and placed in operation by two of the officers of Chemical Design who were, at the time, affiliated with R. B. MacMullin Associates.

Purification plants and bulk hydrogen continue to be available to industry precisely as stipulated in your Aug. 10 issue.

W. E. SCHMID

Chemical Design, Inc. Lockport, N. Y.

Methane, Not Acetylene

Excuse me, but I can't suppress the urge to point out a goof. It appears on p. 53 of your Aug. 10 issue, where you discuss the recent developments in the Henkel process for the production of terephthalic acid.

In conjunction with this you note that the reaction "is carried out in the presence of aluminum carbide, which keeps things dry and provides a blanket of

acetylene.

I'm afraid I wouldn't want to be too close to this reactor if it were blanketed in acetylene. Don't you mean methane?

HERMAN W. ZABEL Roger Williams Technical &

Economic Services Princeton, N. J.

Yes. At least we erred on the safe side .- ED.



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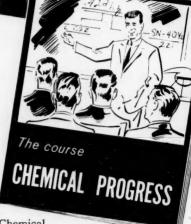
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Pumps, fans, compressors	279
Services & miscellaneous	280

Chemicals

Acrylontrile......is added to pulp to modify its chemical structure & greatly strengthen heat-resistance & retention of dielectric & tensile strength properties.

30-31c *American Cyanamid Co.

Adhesives.....11 p. leaflet investigates the superior adhesion of vinyl plastisol or vinyl film to synethetic fabrics possible with a primer based on dianisidine disocyanate. 262A Carwin Co.

Adipic Acid.....A working sample and a copy of the current Adipic Acid shipping specifications will be furnished on request. High purity & lightest color. 163 *Nat'l Aniline Div., Allied Chem.

Aero Glycolonitrile.....The availability of Aero Glycolonitrile has made possible the use of an easier & better method for producing a-amino acids. Information.

30-31d *American Cyanamid Co.

Ammonium Perchlorate.....4 p. leaflet gives a list of specifications for ammonium perchlorate and lithium perchlorate products of a new plant.

262B HEF Inc.

Amyl Alcohol.....consists of approximately 60% pentanol-1, 35% 2methyl butanol-1 and 5% 3-methyl butanol-1. Available in tank cars or trucks. Bulletin F-8517C. 215a *Union Carbide Chemicals Co.

Anti-Static Agent.....Catanac SN is effective on fibers, including the synthetics. Application may be made by brush, pad, or spray & washable items by adding water.

30-31e *American Cyanamid Co.

Calcined Aluminas.....Two high-purity, uniform quality aluminas available in coarse and fine sizes for manufacture of high grade abrasive and ceramic products.

*Kaiser Chemicals

• From advertisement, this issue

LITERATURE E. M. PLYNN

Carbon Pellets.....New size activated Carbon Pellets are available for catalyst support. Produced in smaller 6/8 mesh pellets. Further details offered. 153a *National Carbon Co.

Carbon Saddles.....withstand abrupt temperature changes without danger of cracking or spalling. Can be used in stripping, absorbing & scrubbing applications. Details.

*National Carbon Co.

Chemicals.....36 p. booklet describes company's products and activities including metal products, business of coke, tar from coal, and trend to chemicals.

263A Koppers Co.

Chemicals....The 1959 Physical Properties of Synthetic Organic Chemicals—a comprehensive description of the properties & applications of more than 400 chemicals.

215b *Union Carbide Chemicals Co.

Chlorine.....The Safety Wall Chart is now available. It tells how to handle tank cars, cylinders & ton containers. Also sections on first aid & emergency measures. 11a *Hooker Chemical Corp.

ChlorineThe Chlorine Manual is now available on request. Its 76 pages are full of useful chemical and engineering information. Send for your copy. 11b *Hooker Chemical Corp.

Corrosion Inhibitor.....1 p. Bulletin 111 describes a new liquid corrosion inhibitor for use with hydrochoric acid, phosphoric and other liquid acids. Meets military specifications. 263B O'Brien Industries, Inc.

Dialdehyde Starch.....39 p. Technical Bulletin 6-129 describes a new organic chemical made from corn thought to have wide industrial potential in plastics, leather, etc. 263C Miles Chemical Co.

Dye.....Calcogas Rocket Red dye is non-dusting, non-caking & extremely soluble. Its granulated form facilitates use in automatic metering & mixing equipment. 30-31a *American Cyanamid Co.

* From advertisement, this issue

Want to build up your files and keep them up-to-date? You can get any publication in this comprehensive guide — free — just for the asking.

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Whenever temperature and performance must go hand in hand SELECT AN RMC

Available in all scale ranges
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Permanent accuracy with freedom from vibration caused variable is built in. Silicone damping and special damping bearing minimize vibration and keep shaft alignment true.

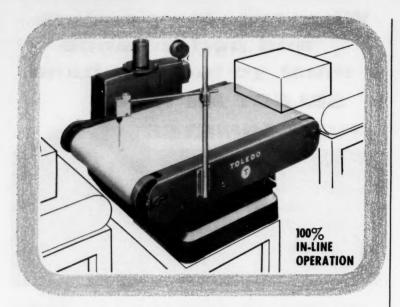
Write, wire or phone for catalog and detailed general specifications. If yours is a special application, tell us your requirements. RMC engineers will work with you in solving it.



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REPRESENTATIVES IN ALL PRINCIPAL CITIES



TOMATIC

MODEL 9460 Items 50 to 200 Lbs., to 40 per min.

MODEL 9463 Items 5 to 50 Lbs., to 40 per min.

Get 100% in-line checkweighing with these new Toledos! Checkweigh bags, cartons, packages, parts and pieces automatically. You'll save time, labor and material . . . keep weights consistent . . . build customer goodwill.

Designed with continuous-running motorized conveyor on the weigh section, these Checkweighers fit readily into conveyor lines . . . are accurate to one part in 3,000. Available with remote zone indication stations for continuous visual check, magnetic counters to accumulate operating data, and other advanced Toledo features.

Now is the time to check into Toledo Checkweighers for your operations! Send for Bulletin 2968. TOLEDO SCALE, Division of Toledo Scale Corporation, Toledo 12, Ohio.

Toledo Automatic Bulk Weighing . . . net weight listing and totaling

Get accurate net weight listing and totaling of bulk materials going into truck or carload



shipments. Weighing is automatic. You save time, control costs and reduce claims. The Toledo control console which interlocks all elements of the system, may be remotely located for operating convenience. Ask for Bulletin 2490.





Headquarters for Weighing Systems

Epoxidation Processes....Bulletin No. 69, "Epoxidation and Hydroxylation with Becco Hydrogen Peroxide and Peracetic Acid" is now available on request. *Becco Chemical Div., FMC

Ether Aerosol.....advantages include reduced dilution and wear, mini-mizing of strain on engine parts and batteries, prevention of down-

time, etc. 241-242d *U. S. Industrial Chemicals Co.

Fluorocarbon Resin.... Hose lined with Tefion TFE resin is rated for continuous use up to 500 F. Tough, long lasting & solves problems of holdup & contamination. Details.

49 *E. I. du Pont de Nemours

orolubes.....a high-density poly-mer of trifluorovinyl chloride. It's available in many grades . . . all are excellent lubricants. Specifica-tions & properties in Data File. 11d *Hooker Chemical Corp. Fluorolubes . .

Hydrogen Peroxide.....Complete information on hydrogen peroxide applications research is now available on request. Up-to-the-minute data is offered.

221 *Allied Chem., Solvay Process Div.

rt Fluids.....are non-explosive, non-corrosive, non-toxic and odor-less. They are ideal as evaporative coolant & insulators. Literature available. L249 *Minnesota Mining & Mfg. Co.

yanates.....11 p. describes the su-perior adhesion of vinyl plastisol or film to synthetic fabrics possible Isocyanates. with a primer coat of dianisidine disocyanate.

264A

Carwin Co.

Mineral Acids.....Complete informa-tion on production, transportation, service & sales facilities geared to meet your requirements is available on request. 99 *Allied Chem., Gen. Chem. Div.

n-Butyl Alcohol.....described in new technical data sheet which contains specifications, properties, shipping and application information. Ad-vantages of the material included. 242c *U. S. Industrial Chemicals Co.

Odorants.....4 p. leaflet describes a new line especially designed for the masking and rescenting of fertilizer products. Odorants are called Fertomasks. 264B Dodge & Olcott, Inc.

Olefin Polymers.....26 p. brochure reports on some of the 400-plus Marlex items now in existence since this rigid polyethylene was first introduced 3 yr. ago.

264C Phillips Chemical Co.

Oxygen Chemicals.....Bulletin No. 1

"Active Oxygen Chemicals" is now
available on request. Detailed information on useful peroxides is of-*Becco Chemical Div., FMC

Phthalic Anhydride.....A new process involves catalytic oxidation of napthalene in fluid bed converters—results in greater purity. Information on Phthalic Arhydride.

30-31b *American Cyanamid Co.

Platinum Catalysts.....in the produc-tion of high-purity chemicals, pharmaceuticals. Brochure, "The Role of the Platinum Group Metals as Catalysts" offered. 14-15a *Engelhard Industries, Inc.

* From advertisement, this issue

Polyethylene.....Metal-organic stabilizer has been developed to protect polyethylene film, sheet and monofilaments against deterioration from ultraviolet action.

241-242e *U. S. Industrial Chemicals Co.

Polyethylene Film is being used in construction because of excellent moisture barrier characteristics, strength and light weight. It is available in wide range of widths. 241-242a *U. S. Industrial Chemicals Co.

Polypropylene Film......Preliminary technical data bulletin, "Some Per-tinent Facts on Polypropylene Film." points out desirable char-acteristics. AviSun Corp.

Silicone Fluids.....Engineering properties of silicone fluids have been assembled in a handy design file. Some graphs are on sheets permitting work to be done on them.

265B Union Carbide Corp.

Silicone Rubber.....8 p. bulletin CDS-188 lists a wide variety of standard industry and military specifications which cover most application re-quirements for silicone rubber. 265C General Electric Co.

Sodium Alcoholates.. ium Alcoholates.....Information on preparation of sodium disper-sions and their use as polymeriza-tion catalysts generally contained .Information

in brochure.

241-242b *U.S. Industrial Chemicals Co.

Sodium Benzoate Flake-form so-dium benzoate is available in two grades: U. S. P. grade & Techni-cal grade. You can get either form in powder form, too. Tech. data. 11c *Hooker Chemical Corp.

lecyl Alcohol.....is the basic ingredient of ditridecyl phthalate, a new high performance plasticizer. Further information about Tridecyl Alcohol in Technical Bul. No. 20.

*Enjay Company, Inc. Tridecyl Alcohol.

Vinylpyrrolidone.....offers a new approach to a wide variety of polymeric products. Information on handling properties, copolymerization procedures, etc. in Bul. AP-86.

29 "Gen. Aniline, Antara Chem. Div.

Construction Material

.. Full information on corrosion-resistant alloys, their properties, forms, the corrosives they will resist, contained in a 104-page book. *Haynes Stellite Co.

d Steels.....Application Engineers have documented cases covering a wide range of materials selection problems to help choose the right steel plate. Bulletin offered. 74 *Lukens Steel Co. Clad Steels.

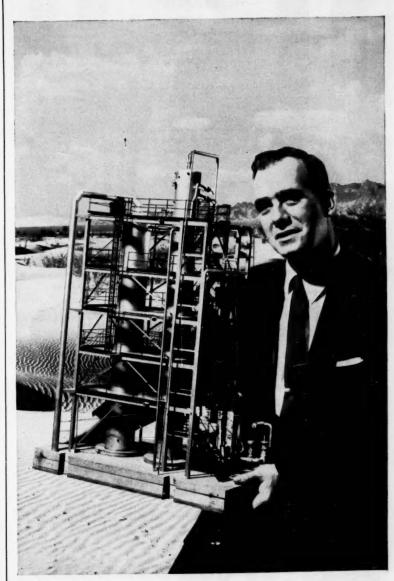
Coating.....Insul-Mastic contains large amounts of Gilsonite, Mica Flakes and Asbestos Fibers. Re-sists corrosion & wear longer than straight asphalt coatings. Details. *Pittsburgh Coke & Chemical Co.

Coatings....."D-A" will withstand temp. up to 600 F. Other Coatings are available in a complete range of types for any condition & temp. up to 2200 F. Catalog No. MPC. B279 *The Markal Company

KEEP YOUR PLANT DESERT-DRY WITH LECTRODRYERS-It's like taking your

plant to the desert if you eliminate unwanted moisture with Lectrodryers. Controls work smoothly and dependably when instruments are fed dry, clean air. Processes stay on the beam and product quality is consistently high, when the air, gases or organic liquids involved are dry. Desert dryness in warehouses safeguards products stored there.

Lectrodryers dry to dewpoints below -110°F.—in volumes of a few cubic feet or thousands per hour. Operation can be fully automatic or manually controlled. Quite likely, there are standard units to suit your needs, or we can recommend special equipment. For this help, write Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd St., Pittsburgh 30, Pa.



ectrodryer ****

[·] From advertisement, this issue

NUGENT

FILTERS • STRAINERS LUBRICATION SPECIALTIES







Fig. 1555BF Duplex Filter uses factory packaged laminated fiber disc filtering elements. Each filter comprising duplex operates independently or in parallel. Wide range of sizes.

Fig. 1576 Bag-Type Pressure Filters feature inexpensive, completely disposable filter cartridges. For filtering fuel oil, lubricating oil and wide variety of fluids.

AT LEFT: Fig. 1555-4L Filter and laminated disc cartridge. High flow rate; low pressure drop. Excellent micronic efficiency. Cartridges interchangeable with all other Nugent Bag or Depth Type cartridges.



Fig. 1554AN-4L7 Duplex Strainers provide the advantage of unterrupted flow, without by-passing, while cleaning the strainer comprising duplex uses 7 strainer baskets Fig. 1554A-4L.



Fig. 1490AM-0 star-shaped extended area strainers offer increased free screen area over round basket type.

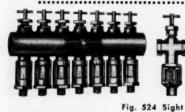


Fig. 1503F Multiple Pressure Oilers are available with from 2 to 24 feeds.



Feed Valves with

removable glass.

to 3/4" IPS.

Fig. 1575 Pressure Sight Flow Lubricator. Single units or multiples to 15.



Fig. 1366E Sight Flow Fittings for indicating flow of liquid in a pipe line. Available in brass, cast iron, steel or stainless steel.

Valuable equipment deserves the best possible protection that can be provided. Nugent offers a complete line of filters, strainers and lubrication specialties for this purpose. All are backed by the experience and know-how gained through solving industry's problems in this field for more than 60 years. For bulletins giving complete information on any or all Nugent products, call or write today.



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OILING AND FILTERING SYSTEMS . OILING DEVICES
SIGHT FEED VALVES . FLOW INDICATORS

LITERATURE . . .

Coatings Unichrome Plastisols when either spray or dip applied provide a seamless, pore-free shield that safeguards against a whole host of corrosives. Bul. VP-3.

271 *Metal & Thermit Corp.

Fabrication.....The illustrated Weldment Bulletin 7001 gives you an excellent idea of the vast fabricating facilities that are available. Send for your copy. 59 "Baldwin-Lima-Hamilton

Filter Media.....New literature guides selection of proper filter media for given types of corrosive conditions. Covers varying concentrations of 125 agents.

266A

Purolator Products

Gaskets.....Booklet, "Armalon for Gasketing Under Extreme Conditions," tells how to reduce gasketing costs. Felts withstand temperatures from —100° F. to 400° F. 165 °E. I. du Pont de Nemours & Co.

Glass Fiber Insulation.....Ultralite blankets—available in widths up to 10 ft. & thicknesses up to 6° provide thermal protection that is permanent & outstanding. Details. 235 *Gustin-Bacon Mfg. Co.

Insulated Equipment Booklet
"Specify Silicone Insulated Motors
and Transformers and Save", gives
the full story on the current revolution in electrical equipment.

157 *Dow Corning Corporation

Insulation.....Metal-On never needs painting. Won't rust. Is impervious to dirt, oils & grime. Provides typ fuel savings & accurate temp. contron. #IN-217A. 16-17 *Johns-Manville

Insulation.....Sample of Foamglas & information on two new products; Foamglas Stay-Dry pipe Insulation & new 1%" Foamglas Roof Insulation is available.

144 *Pittsburgh Corning Corp.

Insulation, Block.....is able to withstand temperature range up to 1900 F. Lightweight, easily installed. Effectively resists steam & other moisture.

146 *Eagle-Picher Co.

Insulations.....Gem-Foam is a rigid polyurethane foam with a closed cell structure, assuring low permeability. Brochure of Gem-Foam & Gem-Fil. 115 *Baldwin-Ehret-Hill, Inc.

Irons....Eight Ni-Resist irons to choose from Answer all your corrosion problems. All the details in "Engineering Properties and Applications of Ni-Resist." 142 "International Nickel Co.

Metal Pall Rings.....are available in %", 1", 11½" & 2" sizes in carbon steel, stainless steel, nickel, monel, iconel, titanium, copper & aluminum.

92

*U. S. Stoneware

Metals & Stainless Steel Castings.....

Five types of stainless steel and twelve metal formulations are available. Technical bulletin on Metals & Stainless Steel Castings.

*Waukesha Foundry Co.

Plastic.....Penton for the solution to your corrosion problems. Valves & many other components for chemical processing systems available. Additional information. 91 *Hercules Powder Co.

* From advertisement, this issue

- Platinum Clad Sheet, Tubing & Wire
 make it possible to incorporate all the important corrision resistant qualities of the noble metals
 in equipment.
 14-15e *Engelhard Industries, Inc.
- Platinum-Group Metals.....Facilities are available to produce platinum clad metals to your exact specifications in sheet, wire, tubing, foil & gauge. Catalog Sheet PLA-5.

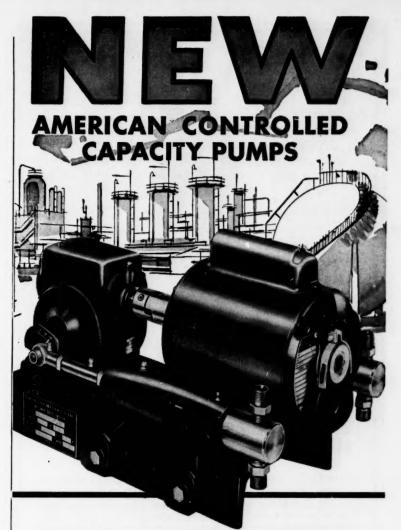
 4 *Metals & Controls Div.
- Wire Cloth.....A 94-page catalog & stock list gives the full range of wire cloth available, describes fabrication facilities & gives useful metallurgical data.

 152 *Cambridge Wire Cloth Co.

Electrical & Mechanical

- Are-Furnace Transformers....Bulletin gives descriptive and technical data on transformers for electric arc furnaces. Tables of performance, prices. To 35,000 kva. 267A General Electric Co.
- Brushless Generators.....Characteristics of high-speed, packaged brushless generators in 40 to 300kw. ratings described in new bulletin. Constant voltage. 267B Allis-Chalmers Mfg.
- Clutches.....New catalog describes five standard lines of spring clutches in bore sizes from ½ to 1 in. and torque capacity to 1,250 lb.-in. For drives to 5 hp. 267C Curtiss-Wright Corp.
- Dry Fluid Drives.....Flexidyne is available, off the shelf, in Drives & Couplings. Capacities range from fractional to 1,000 hp. Technical bulletin.

 228 *Dodge Mfg. Corp.
- Mechanical Seals.....Chemiseal in standard sizes to fit all pump shafts from %" to 2\%"; special sizes also available. Complete details in Catalog AD-164. 272 "The Garlock Packing Co.
- Motor.....The Duty Master line from protected open to totally enclosed, explosion-proof. 1 to 250 hp, is available. Complete story contained in Bul. No. B-2106.
 293 "Reliance Elec. & Engineering
- Motor Control.....A complete line of low voltage control (size 0 through 8) and high voltage control in all NEMA enclosures, plus engineered control systems. Details. 203 *Allis-Chalmers
- Motors SEALEDPOWER totallyenclosed fan-cooled motors include explosion-proof designs in all ratings up to 300 hp. Newest data given in Bulletin PB 6000.2. *Elliott Co.
- Screw Conveyor Drive.....features: a complete drive, seal housings, removable drive shaft, trough end, and all-steel motor mount. Detailed information in Bul. 7106.



JOB ENGINEERED FOR LONG-TERM ACCURACY AND LOWEST MAINTENANCE COSTS

New American controlled capacity pumps are precision built to meet the needs of Chemical Processing, Refining and Boiler Feed applications. Quality construction assures highest accuracy in feeding precisely metered fluids or slurries into low or high pressure systems in virtually all desired ratios, with flow, temperature, pressure, conductivity, PH and other controlled process variables. Control may be manual or automatic—with electric, hydraulic or pneumatic systems.

Newly designed models are available to handle a wide variety of "tough," corrosive and viscous materials.

Write today for full information on American's new controlled capacity pumps. They're sure to meet your fluid proportioning requirements.

"Ask for Catalog 100"



High Pressure Pumps • Controlled Capacity Pumps • Chemical Feed Systems
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[•] From advertisement, this issue



HOT SPOT in your plant!

Guard spray booths, dip tanks, record vaults against the danger of fire! Guard them 24 hours a day with a Kidde fully-automatic carbon dioxide fire extinguishing system. Finest fire protection on the market today, Kidde systems give you these outstanding features that come from more than thirty-five years' experience!

All operating parts completely enclosed to guard against fouling or accidental operation.

No clumsy triggering methods or falling weights.

Self-contained; no outside power needed.

Visual indicators to show if system has been operated.

Easy testing of all operating parts.

No parts to replace after operation or test.

Fast-acting clean carbon dioxide does the job that no other extinguishing agent can do: snuffs fire out in seconds, then vanishes into thin air. Won't harm valuable machinery, leaves no mess to clean up. Write for Kidde's pressure operated carbon dioxide fire extinguishing systems booklet today.

Kidde

Industrial and Marine Division

walter Kidde & Company, Inc. 1028 Main St., Belleville 9, N. J.

Walter Kidde & Company of Canada Ltd., Montreal—Toronto—Vancouver

LITERATURE . . .

Solenoid Starters.....Details on combination starter in screw type enclosure for hazardous gas & hazardous dust locations covered in Bulletin 713.

*Allen-Bradley

Switching Centers.....New concept in power switching centers—providing economy and flexibility through building-block design—is described in comprehensive builetin.

268A I-T-E Circuit Breaker Co.

Turbines Multi-stage, hi-speed turbines available in five frame sizes with wheel diameters ranging from 12 in. to 32 in. Details available. 72 *Westinghouse Electric Corp.

Turbines, Solid-Wheel.....for mechanical drives. Capacities from 5 to 2,000 hp., speeds up to 10,000 rpm. Vertical turbines built in sizes from 5 to 300 hp. Bul. S116.

84 *The Terry Steam Turbine Co.

Variable Transformers.....New 126-226 series for control applications having up to 12.5 amperes constantcurrent loads ... up to 18.0 amperes constant-impedance loads. Bul. 45-46b *The Superior Electric Co.

Variable Transformers.....The 10B series features include a rhodium-plated commutator surface & space-saving core & coil design. Bulletin gives details.

45-46a *The Superior Electric Co.

Worm Gear.....Complete information on any application where specialized worm gear know-how is required. Catalog 201F gives complete data on build-in Worms and Gears. 79 *The Cleveland Worm & Gear Co.

Handling & Packaging

Air Conveying.....Role of pneumatic conveying equipment in the pulp and paper industry is topic of new bulletin. Photographs, and specification tables. 268B Fuller Co.

Bagging Scale.....The E-50 is accurate within 1 ounce at speeds of ten or more 50 lb. bags per minute. Full details on the E-50 & other bagging scales offered.

269 "Richardson Scale Co.

Conveyors.....for all materials handling needs. Belt conveyors, bucket elevators, screw conveyors, feeders, and complete conveyor systems are available.

R288 *Continental Gin Co.

Gas Supply Trailers.....with manifold & controls for your gas & handling requirements. Cylinders, Safety Devices, Controls, etc., in accordance with ICC requirements.

BL275 *Independent Engineer. Co.

Materials Handling Equipment.....
The H-25 Payloader 2,500 lb. carry capacity, 6-ft. turning radius, power-shift transmission & easy power-steer. Data.

32 *The Frank G. Hough Co.

Pneumatic Conveyors compact conveying systems eliminate costly complex installations. Available in stationary and portable models for in-plant or outside.

T238 *Daffin Manufacturing Co.

^{*} From advertisement, this issue

Pneumatic Conveying Systems.....A new line of pneumatic conveying systems is the topic of Bulletin P-259. Feeders, blowers, separators, valves, control panels. 269A Young Machinery Co.

Screw Conveyors & Components.....
The 76-page Book 2989 contains detailed sections on components, lay-out, drive arrangements, dimen-sional data, etc. *Link-Belt Co.

Heating & Cooling

oclaves.....8-page brochure avail-able on autoclaves, kettles, pan and horizontal dryers (continuous and Autoclaves... batch), reactors, chemical castings.

Bethlehem Foundry & Machine Co.

Conditioning System.....Rota-spray units are self-cleaning, and require no filters. Four sizes: 10,500 to 30,000 cfm. available. Complete information on system. 62 *Carrier Corporation

Aters.....Catalog 956 covers Grid Unit Heaters, Blast Heaters and Radiators. Designed for operation on steam pressure up to 250 PSI 450 degree temperature.

232 *D. J. Murray Mfg. Co. Heaters

Heat Exchangers.....Standard heat exchangers are suitable for a wide range of services, including heat-ing, cooling, vaporizing & con-densing. Details in Bul. B-20. 137 *Struthers Wells Corp.

Heat Transfer Cements.....Catalog describes properties and uses of Thermon cements, pastes which cure to form unbroken thermal con-nection between coils, tracing, etc. 269B Thermon Mfg. Co.

Kilns, Rotary.....Kiln shells are fabricated of quality steel plate. Complete details contained in Bulletin No. 1115, now available on request. Send for your copy.

53 *Traylor Engineering & Mfg. Co.

Plate Heat Exchanger.....feature top efficiencies, maximum tempera-ture control, and higher capacities. Complete information is now avail-

able on request. 18-19a *The De Laval Separator Co.

Refrigerated Purging.....Bulletin pre-sents helpful data on the automatic removal of air from refrigeration systems. Tells when purging is necessary, selection. 269C Armstrong Machine Works

inless Steel Equipment.....for heating & cooling fluids, condens-ing gases, evaporating liquids, dis-sipating waste heat, etc. Brochure **Stainless** on equipment. *Marlo Coil Co.

am Trap.....The 48-page Book contains additional information on trap capacity ratings, plus data on how to correctly size, install & maintain steam traps. 154 *Armstrong Machine Works

Steam Trap.....Impulse Traps test for condensate in the line ahead of the trap & operate to discharge it as soon as it forms. Bulletin "The Why and How of Steam Trapping." 71 "Yarnall-Waring Co.



If you overweigh you lose money ... If you underweigh you lose customers!

Richardson Automatic Bagging Scales are the answer to this problem. They provide high speed bagging with accuracy that eliminates giveaway of product, avoids customer complaints of shortweights. Higher production speeds mean reduction in costs, too.



The Richardson E-50 Bagging Scale gives you all these benefits -

Accuracy - within 1 ounce at speeds of ten or more 50-lb. bags per minute!

Versatility - handles weighings from 5 to 200 lbs. of grains, plastics, powdered and granular chemicals, feeds and meals, pellets, sugar, salt, and many others.

Dependability-ruggedly-built for years of trouble-

For full details on the Richardson E-50 and other bagging scales write today.

Richardson Scales conform to U.S. Weights and Measures H-44 for your protection.





1790 RICHARDSON SCALE COMPANY . CLIFTON, NEW JERSEY Sales and Service Branches in Principal Cities • Also manufactured in Europe to U.S. standards

^{*} From advertisement, this issue

HOW TO GET STAINLESS STEEL FITTINGS-FAST



Here's a case in point! 9 AM—"rush" Distributor's telephone order received at factory. 10:15 AM—all but one fitting found to be in factory stock. 3:30 PM—special production on missing item completed. 4:50 PM—order shipped and on its way the same day.

High-speed delivery to the job is a promise many offer, but often find hard to back up. We believe we have the answer in a special brand of teamwork—where your W-S Distributor carries major stocks . . . even in stainless and alloy steel . . . and can call on the W-S plant for exceptionally fast replacement orders.

Time after time our type of teamwork comes through.

For your next order—emergency or not—give your W-S Distributor a call and try his service. You'll find it complete in every respect. And you get the famous W-S quality materials and machining, too. For your nearest Distributor's name as well as full details on the W-S Fittings line, write Forge and Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, New Jersey.





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STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE
DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston"
Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

Instruments & Controls

- Checkweighers.....Model 9460 items 50 to 200 lbs., to 40 per min. Model 9463 items 5 to 50 lbs., to 40 per min. Further information in Bulletin 2968.

 264a *Toledo Scale Corp.
- Digital Computer....Brochure describes applications of the Burroughs 205 electronic digital computer system in the petrochemical industry. On request.

 270A Burroughs Corp.
- Precition LGP-30 operates in many process industry applications. No site preparation is necessary. Complete information on request.

 140 *Royal McBee Corp.
- Flowmeters.....New line of flowmeters provide highly accurate flow measurement for wide variety of liquids and gases. Eight-page bulletin now available.

 270B

 Matheson Co.
- Gauge, High Pressure.....has pointer connected directly to pressure element. Available in pressure ranges from 0-1000 to 0-10,000 psi. Complete information.

 262 *Rochester Mfg. Co., Inc.
- Gauges.....Complete details on Tank Contents Gauges are available. All models feature large easy-to-read dials. Remote reading . . . no power required. T279 *The Liquidometer Corp.
- Gauges.....Over 50,000 standard indicating dial pressure ranges available. Thousands of choices in cas styles, sizes, materials, & in gauge components.

 68 *United States Gauge
- Indicator.....Level-Tel 154 is a precise, continuous reading level indicating system consisting of a probe detector, transmitter, & indicator. Bul. RF-5915.

 145 *Robertshaw-Fulton Controls
- Indicators.....Bulletin 65 covers a line of new self-balancing indicators and indicating controllers. Specifications for high-gain servo-amplifier given.

 270C Thermo Electric Co.
- Leverage System.....Literature on "Flexure Plate" Leverage System, its application to filling, batching and checkweighing operations available.

 R239 *Thayer Scale Corp.
- Meter.....Auto-Stop Meter delivers the same quantity accurately every time the valve is opened. Shuts off automatically. All the facts in Meter Data Bul. 566 D. 257 *Neptune Meter Co.
- Net weight Listing & Totaling.....of bulk materials going into truck or carload shipments. Weighing is automatic. Complete information contained in Bulletin 2490. 264b *Toledo Scale Corp.
- Radiation Measuring Systems.....For density or specific gravity and liquid-level control. Gages provide continuous, accurate, automatic control. Bul. 105-C. 270D Ohmart Corp.

^{*} From advertisement, this issue

Radioactivity Monitor Bulletin M-59 describes system for detect-ing, measuring and recording radio-activity. Included are portable and remote units.

Nuclear Measurements

Thermocouple Weils Catalog G102-1 includes well designs & dimensions, pressure & temperature ratings, corrosion data, thermocouple assembly data, etc.

52 *Minneapolis-Honeywell

Thermometer.....in all scale ranges from 150 F to 1000 F; dial sizes from 1" to 5"; stem lengths from 2½" to 72". Complete adaptability to any installation. Catalog.

263 *Rochester Mfg. Co.

nsmitter.....The 205T Volumetric Differential Pressure Transmitter can solve your most difficult flow & liquid level measurement problems. Bulletin 98381.
54 *Taylor Instrument Co.

Transmitters.....solves flow pulsation problems with adjustable internal damping. Complete information on this system in Bulletin 91-251. Send for your copy. 156 *Fischer & Porter Co.

Pipe, Fitting, Valves

Condenser Tube.....Trufin Type S/T is specifically designed for shell & tube application. Process Flowsheet booklet is filled with information.

*Wolverine Tube Div...
Calumet & Hecla

Connectors.....permit fast, easy making and breaking of thermocouple circuits. Durable construction guarantees long usage. Bulletin 23-E.

B238 *Thermo Electric Co., Inc.

Expansion Compensators.....to han-dle pipe expansion under condi-tions of higher pressure, higher temperature, corrosive fluids, chem-icals & gases. Catalog No. 205. 161 *Flexonics Corp.

Hose.....4 p. leaflet on industrial and municipal fire hose discusses the trend to jacket both types of hose with Dacron poly-Fire Hose types of h ester fiber. 271B Du Pont Co.

tings, Stainless Steel.....Your nearest Distributor's name as well as full details on the W-S Fittings line is now available on your re-Fittings. quest. 270. *H. K. Porter Company, Inc.

Hose.....Teflon hose is available up to 2" diameter, lengths to 25'. Mini-mum bend radius is only 3½ times diameter. Bulletin on Springfield diameter. Bullet "400" is offered. *Titeflex Inc.

e.....All-purpose rigid PVC in schedules 40, 80, & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". Bulletin CE-56, for details. 246a *American Hard Rubber Co.

e......High impact rubber-plastic, most economical for average chem-icals. Screw or solvent welded fit-tings. Valves ½ to 2". Bulletin 80A. *American Hard Rubber Co.

MORE WAYS TO PROFIT FROM PLASTISOLS



corrosion protection with Unichrome Plastisols

AVOIDS COSTLY MAINTENANCE

Impellers made of ordinary steel coated with plastisol withstand chemicals that even stainless steel impellers cannot. And it's practically "lifetime" protection for tanks lined with this baked-on vinyl coating. What better way to stretch service life of equipment; to cut out maintenance?

Spray or dip applied, Unichrome Plastisols provide a seamless, pore-free shield that safeguards against a whole host of corrosives. This resilient coating won't chip, resists abrasion. Costs less than applying vinyl sheet materials, too. Objects of any share or size can be coated ... so long as they can be maintained at baking temperature.

Expert applicators are strategically located to handle your equipment promptly. Or your own crews can do it. Send for Bulletin VP-3.



coatings and finishes

METAL & THERMIT Corporation

General Offices: Rahway, New Jersey

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COMPLETELY UNHARMED BY THE STRONGEST CHEMICALS

Garlock Chemiseal Mechanical Seals have, through years of application, proved their ability to seal effectively against all chemicals . . . from the "easier" Methanol, Acetic and Propionic Acids to the more reactive Hydroxyacetic, Sulfuric, Adipic Acids and Hydroxarbon Slurry.

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Solve your difficult sealing problems. Apply Garlock Chemiseal Mechanical Seals against all media—including solids in suspension—in pressures to 100 psi at 75°C, or 75 psi at 100°C. Standard sizes to fit all pump shafts from $\frac{7}{8}$ " to $\frac{2}{8}$ "; special sizes also available. Chemiseal Mechanical Seals are another of the Garlock $\frac{2}{9}$ 00 . . . two thousand different types of gaskets, packings, and seals for every need. Discuss complete details with your local Garlock representative, or write for Catalog AD-164.

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Packings, Gaskets, Oil Seals, Mechanical Seals, Molded and Extruded Rubber, Plastic Products



Canadian Division: The Garlock Packing Co. of Canada Ltd., Plastics Division: United States Gasket Company

- Pipe.....Saran Lined Pipe, fittings, valves & pumps are available for systems operating from vacuum to 300 psi, from below zero to 200 F. Information available.

 127 *The Dow Chem. Co.
- Pipe.....%" through 1½" pipe, with companion fittings and valves, operating at continuous temperatures of 125°F. at maximum pressures of 40 p.s.l. Booklet. 178°Joseph T. Ryerson & Son, Inc.
- Pipe & Fittings.....with Fluoroflex-T are ideal for service to 500 F. Data on Fluoroflex-TS pipe & fittings for complete piping systems is offered.

 159 *Resistoflex Corp.
- Pipe Line.....Features and advantages of line pipe manufactured by the electricweld method are presented in new pamphlet. Complete table of specifications. Illustrated.

 272A Jones & Laughlin Sted.
- Pipe, Plastic.....Ace-Ite, chemicalresistant rubber-resin blend pipe is the surest way to stem the tide of corrosion. Handles most chemicals. Bulletin CE-80. 247 *American Hard Rubber Co.
- Tubing.....Full information on Job-Matched Seamless Pressure Tubing is contained in Bulletin TB-417. Wide size range & uniform dimensions & mechanical properties. 82 *The Babcock & Wilcox Co.
- Tubing.....Complete information on Damascope Testing is contained in four-page bulletin explaining operation & other pertinent data on Damascope inspection.

 70

 *Damascus Tube Co.
- Tubing Shaped.....Shaped tubing in square, rectangle, elliptical, oval and other cross sections is illustrated and described in Data Memorandum No. 17. Many alloys. 272B Superior Tube Co.
- Valve The %" Self-Closing Ball Valve is designed for smooth, leak-proof handling of highly flammable liquids. Complete details are available. *Rockwood Sprinkler Co.
- Valve.....New Pressure Sealing Gate valve is ideal for abrasive ladings, light gases, volatile liquids up to 250 F. Catalog 1200. "W-K-M Div. of ACF Industries 33-38
- Valves.....Full facts on "Craneloy 20" and other quality alloy valves contained in Circular AD-2080. Free-to-rotate discs minimize seating wear & prevent galling. 175 "Crane Co.
- Valves.....Iron Body Check Valves & Gate Valves may be obtained with special hard rubber linings. High resistance to corrosion & abrasion. Further information offered.

 *Barling Valve & Mfg. Co.
- Valves.....Hamer Line Blind Valves are fast, safe, simple to operate. One man can open or blind a line in one minute. Further information in catalog. *Hamer Valves

* From advertisement, this issue

ves.....Ideal for leakproof control of air, vacuum, steam, water, fuels, olls, kerosene, alcohol, etc., the Flo-Ball features all stainless steel construction. Valves. *Hydromatics, Inc.

Valves.....Solid Porcelain acid proof valves offer purity, protection & permanence of your chemical lines. Complete description & specifications available.
73 *Lapp Insulator Co., Inc.

ves.....The Educator Tube in Standard Consolidated Safety Re-lief valves is a pressure evacuator. Cat. 1900.

Manning, Maxwell & Moore, Inc.

ves, Butterfly.....for gas, vapor, liquid or semi-solid control prob-lems. Simplicity of design makes them easy to service & maintain. Literature. *Fisher Governor Co.

Valves, Control.....for hot or cold flows...or other process flow con-ditions. Available in a wide range of types & sizes. New Catalog C800-1.

*Minneapolis-Honeywell

ves, Control.....apply heat uniformly throughout the valve from flange to flange and up to the stuffing box. Sizes ranges from 1½" to 4". Catalog 356-S.

L239 **Parks-Cramer Co.

Valves, Diaphragm.....offer dependable performance & long service life for vacuums down to 0.1 micron ... with leak rates of less than 0.1 micron cubic foot/hour. Facts *Grinnell Co.

Valves, Plastic-Coated.....The plastic coating of these valves offers com-plete corrosion resistance. Replace-ment costs eliminated. Information available.

*DeZurik Corporation

ves, Plastic.....Bulletin covers the use of polyvinyl chloride in valve trim and diaphragm protectors. Included are various applications and technical data. On request.

273A J. E. Lonergan Co. Valves, Plastic.

ve, Plug.....The new Type G Durco Sleeveline offers 150 psi rating. Ductile or stainless screwed or flanged ½" to 2" sizes. Ductile flanged sizes to 6". Bul. V/12. 225 "The Duriron Co.

ves, Plug Lubricated Plug valves are available in sizes ½" through 16", depending on the type required. Features 3 basic parts, Body, Bonnet, Plug. 123 *The Wm. Powell Co.

ves, Safety-Relief Complete information is provided in Catalog FE-118, covering both selection & sizing of Farris process Safety-Relief Valves.

*Farris Engineering Corp.

Valves, Spherical Plug.....Illustrated bulletin covers line of full-opening, lubricated spherical plug valves. Specifications and dimensions for sizes to 30 in. Rockwell Mfg. Co.

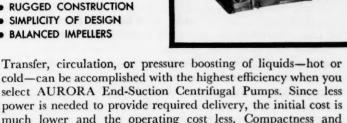
Valves, Stainless Steel.....A new catalog outlines patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services. *Jenkins Bros.

Minimize Liquid Handling Costs

with CONTROLLED PERFORMANCE AURORA® END-SUCTION CENTRIFUGAL PUMPS



- CAPACITIES TO 1800 G.P.M.
- · HEADS TO 320 FT.
- HIGH EFFICIENCY
- LOW NPSH
- **FLEXIBILITY**
- COMPACTNESS
- PROVEN DEPENDABILITY
- RUGGED CONSTRUCTION
- SIMPLICITY OF DESIGN
- BALANCED IMPELLERS



select AURORA End-Suction Centrifugal Pumps. Since less power is needed to provide required delivery, the initial cost is much lower and the operating cost less. Compactness and simplicity of design saves space and makes installation faster and easier.

Unique suction spool arrangement permits disassembly for maintenance without disturbing the discharge connection, pumpmotor alignment or foundation bolts.

Vertical discharge makes pump self-venting, avoids vapor locks, and permits smooth running operation with a controlled noise level.

Typical applications include: condenser circulation, boiler feed, cooling towers, air conditioning systems, hot water circulation, and pressure boosters for water systems.

WRITE FOR BULLETIN 119-C



AURORA PUMP DIVISION THE NEW YORK AIR BRAKE COMPANY

670 LOUCKS

AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

[•] From advertisement, this issue



3 years of soil removed from 55-ft. ethylene scrubber tower by Oakite chemical circulation

What's the fastest way to clean a 55-foot tower?

A midwest chemical plant had this problem recently on an ethylene scrubber tower with an accumulation of three years of iron oxides, oil deposits and sludge.

The local Oakite man analyzed the soil and recommended a specialized cleaner to be circulated through the tower. He also recommended the most efficient solution strength, temperature, and gpm of circulation. He remained on hand for consultation during the hook-up and while cleaning was in progress.

Fifteen hours of chemical circulation followed by six hours of rinse removed every trace of soil. The tower was three years younger... and at a fraction of the cost of manual reconditioning.

On any cleaning problem - towers, tanks, pumps, compressors, exchangers, lines, fittings, valves - call your local Oakite man. Or write for literature and details to Oakite Products, Inc., 16H Rector Street, New York 6, N. Y.



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Process Equipment

- Centrifugals.....Reineveld Horizontal Separators can be opened, thor-ougly cleaned & inspected in ½ hour. Sanitary operation at all times. Bulletin 356. TL275 *Heyl & Patterson, Inc.
- Centrifuge.....The AC-VO "Nozzle-Matic Centrifuge offers higher capacities. Insure maximum cat-alyst life. Further information is available. 18-19c *The De Laval Separator Co.
- Cooling Towers.....with high thermal performance, low maintenance cost & built-in permanence. Catalog de-scribes in detail the designed quality. *The Fluor Corporation
- .. in 4 different ca-Cryogenerator.
- 12-13
- Dispersion Mixers.....offers many special features for processing solid propellants. Available in a complete range of laboratory & production sixes. Bul. 1157. *The J. H. Day Co.
- ers.....Lectrodryers dry to dew-points below 110 F., in volumes of a few cubic feet or thousands per hour. Operation can be fully auto-matic or manually controlled. 265 *Pittsburgh Lectrodryer Div.
- Dust Collector.....Characteristics and operation of the AMERclone dry centrifugal dust collector are discussed in new product bulletin. Sizes to 72,000 cfm. American Air Filter Co.
- t Collector.....Dustex patented design prevents condensation within the collector where inlet temp. is above the dew point. Handles temp. up to 800 F. Bulletin on D-584. 288L *Dustex Corp
- st Collectors.....Cyclones have the unique Shave-off port that traps small fines in the double eddy cur-rents. All 3 Systems are illustrated & described in booklet. 278 "Buell Engineering Co. Dust Collectors
- at Scrubbers.....Bulletin covers high-efficiency, direct-contact gas scrubbers for removal of particulate matter, including sub-micron dust and fumes, gases.
 274E Peabody Engineering Corp.
- at Collectors.....New Bulletin 300 gives details & illustrations of the new Cyclo-trells mechanical dust collectors and hopper discharge Dust Collectors ... valve. *Research-Cottrell. Inc.
- Dust Control.....New data and information on dust control with the manufacturer's cloth filter dust collectors is topic of new literature. Rating tables. Torit Mfg. Co.
- ctrolytic Cells....."Hooker Type S Cells" is a completely revised edi-tion of former Bulletin 20. Covers cell history through cell operation. Operating data. Electrolytic Cells. Cells" is a co

^{*} From advertisement, this issue



This means sanitary operation at all times and at least double the output of any other machine. Yield is higher, too, as solids remain undisturbed after separation until cut-out.

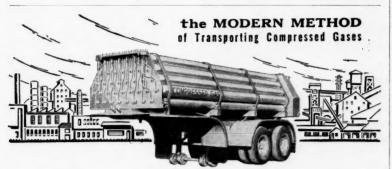
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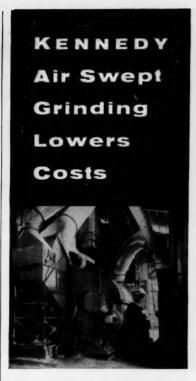


INDEPENDENT ENGINEERING COMPANY, Inc.

CONSULTING DESIGNING

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O'FALLON 7, ILLINOIS



KENNEDY Air Swept Grinding Systems Reduce Production Costs—through

Capital Savings—Less floor space and structural steel are required per ton of product.

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Send now for full details.



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MANUFACTURING & ENGINEERING CORPORATION
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1926 NORWALK compressor is readied for use



This four-stage, 133/4 x 12 Norwalk compressor for air or hydrogen was purchased by Linde Company, Division of Union Carbide Corporation, in 1926 and used continuously for 32 years for the compression of hydrogen. During this time the cylinder has been relined five times. Old #3410 was recently moved to Linden, New Jersey, where it is now ready to go into production when needed.

Every Norwalk compressor is test-run at the factory, then taken down for complete inspection before re-assembly and shipment. Norwalk makes compressors from single stage to six stages, from 125 to 25,000 psi pressure, for gases as follows:

> ACETYLENE ARGON CERTAIN HYDRO CARBONS CO AND CO2 ETHANE

ETHYLENE HCL HELIUM HYDROGEN NITROGEN NITROUS OXIDE OXYGEN

for full details, write for Catalog 44

NORWALK COMPANY, INC.

SOUTH NORWALK, CONNECTICUT

Established 1864

LITERATURE . . .

- Evaporators.....A list of experts who have chosen G-B equipment along with more comprehensive information on the complete line is now available to you.

 280 *Goslin-Birmingham Mfg. Co.
- Filter....Bulletin describes the design, operation and advantages of the American filter, a disk-type unit for the process industries. Photos and drawings.
- er.....EimcoBelt is a perfected continuous belt drum filter. When equipped with cloth or metallic me-dium, it eliminates blinding. Bulle-tin F-2053. Cover The Eimco Corporation
- Filter, Glass-Bag.....for the toughest industrial applications such as: cement kilns, reverberatory fur-naces, calciners, converters, etc. De-tailed information. 158 *Dracco Div. of Fuller Co.
- ers.....Custom-made units provide solutions to many difficult continuous filtration problems in the CPI. Bulletins & technical advice offered.
- *American Machine & Metals, Inc.
- Filters.....Niagara are available in completely automated models for production-line filtration. Operate with process streams from 50 to over 1,000 gal/minute. Data. 252 *American Machine & Metals, Inc.
- Grinding Mills.....including Rod, Ball, Pebble, Tube & Compartment types. In sizes from 6 to 13 feet in diameter & up to 50 feet in length. Further details offered. 20-21 *Nordberg Mfg. Co.
- ronizers.....grind & classify in one operation in a single chamber & provide fines in range from ½ to 44 microns. Eight models are available. Bul. No. 091. *Sturtevant Mill Co. Micronizers . . .
- is.....that will multiply your production in less space, at less cost. There is a model for every need—from laboratory testing to big volume production. Details.

 *Morehouse-Cowles, Inc.
- ls, 3-Roll.....are built in 10" x 22" and 14" x 30" sizes for production quantities; in 5" x 12" & 4" x 8" sizes for pilot operations. Bul. 158. *The J. H. Day Co.
- Mill, Imp.....for both drying and grinding. Further details on Ray-mond Imp Mill contained in Bulle-tin No. 85 which is available on re-*Combustion Engineering
- Mills, Roller.....with exclusive gear-less & spur gear drives. Quality fine grinding . . . 20 mesh to 400 mesh . . micron sizes on some materials. Catalog. 85 *William Patent Crusher
- Mills & Mixers.....Complete information on high speed three roll mills and production size dispersion type change can mixers is available. L233 *Charles Ross & Son Co.
- Mist Eliminators.....In all types of processing equipment—Metex mist eliminators knock back liquid entrainment. Bulletin ME-9 for latest design guides.

 254 *Metal Textile Corp.

^{*} From advertisement, this issue

Pony Mixers.....twin or single motion, provide fast, thorough mixing of curing agents & high performance fuel additives. Complete information in Bul. 500.

*The J. H. Day Co.

Pressure Vessels......New brochure shows variety of pressure vessels; fabricating techniques utilized in production of equipment also shown. Many applications.

277A Solar Chicago

ess Equipment.....Bulletin illustrates and describes representative equipment lines from each of three Process Equipment.

cess Equipment.....Air Swept Grinding Systems are available for a wide range of capacities and products. Full details are available on request. R275 *Kennedy Van Saun

Process Equipment....A complete line of filters, strainers and lubrication specialties are available. Bulletins giving complete information on all *Wm. W. Nugent & Co.

eessor.....Holo-Flite for processes where slurries, granular solids, pulps or pastes are cooled, heated or dried. Bulletin gives details on installation & operation. 101 *Western Precipitation Corp. Processor...

bon Blenders....in a variety of materials ... with powerful drives ... and various types of agitators ... in capacities that range from 7½ to 3850 gal. Bul. No. 800. 50c *The J. H. Day Co. Ribbon Blenders...

Ro-Ball Gyrating Screens.....Bulletin 957 covers the many models that are available to provide from two to five separations, with choice of discharge designs. 50e *The J. H. Day Co.

Rotary Cooler-Blender.....with 7'-0" diameter x 30'-0" long. Catalog A can help you with your Pressing, Drying and Cooling Problems. T290 "Davenport Machine & Foundry Co.

Screen Separator....The Syncromatic is available in carbon or stainless steel, & may be obtained with from 1 to 3 decks, & a full range of screen meshes & materials.

18-19b *The De Laval Separator Co.

Semicontinuous Deodorizers.....Design and process features overcoming drawbacks of conventional apparatus for deodorization of fat and oil products is topic of bulletin.

277C Girdler Process Equipment

arators.....Operating principles of a line of separators, as well as applications in the clay products industry, are covered by a new bul-letin. High capacity, low space. 277D Southwestern Engineering Co. Separators.

Stream Splitters.....Revised bulletin describes a compact and efficient line of stream splitters for free-flowing materials. Gives from two to eight streams. 277E Sprout, Waldron & Co.

Water Knives.....Bulletin on flat spray nozzles for any type of wash-ing, cleaning, descaling and cooling operation now available. Selection data, specifications. 277F Chain Belt Co.

WORLD **STANDARD** OR SAFET

in process safety-relief valves

From the Near East to our own Far West ... the name Farris on safety-relief valves has been a standard synonym for safety since 1943. The patented design features on all Farris full-nozzle valves combine to offer the ideal concept of a trouble-free, 100% safe safety-relief valve for every application.

SERIES 2600

The most popular top-guided, self-aligning, safety-relief valve for process piping service. Maximum pressure, 150 to 2500 psig, RF/RJ. Plain or Lever types. Standard or BalanSeal bellows construction.

SERIES 2740

A cast-steel relief valve of simplified design for use where extreme blow down accuracy is not essential, but where durability, compactness are. Pressures to 3500 psig at 450°F; 2000 psig at 800°F. Sizes 1/2" to 2".

An extremely rugged, compact, high pressure bar stock nozzle valve. Internal parts stainless steel. Adjustable blow down; flat seat; self-aligning stem and disc. Pressure to 10,000 psig. Sizes 1/2", 3/4", 1".

SERIES 2950

A cast iron safety-relief valve including most of the exclusive Farris features found in the Series 2600. Max. pressure, 250 psig at 450°F, 400 psig at 150°F. Plain cap, open lever or packed lever types.

Complete information is provided in Catalog FE-118, covering both selection and sizing of Farris process Safety-Relief Valves. Send for your copy today.



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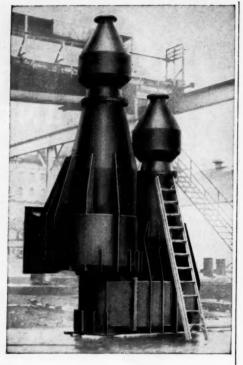
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²⁷⁴⁰ 2745 2950

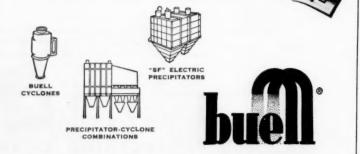
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Exploring new frontiers!

But these aren't satellite launchers, though they're specially designed for high temperature operation: they're Buell extra-efficient cyclone dust collectors . . . and the new frontiers they're exploring are in industry. Everywhere in American industry, from cement mills to refineries, from chemical plants to power generating stations, Buell collectors set new records in percentage of dust removed, low maintenance, and improved plant operation. Even in the age-old field of fly ash collection, Buell extra efficiency pays off. Only Buell cyclones have the unique Shave-off port that traps small fines in the double eddy currents. And Buell large-diameter design eliminates bridging, clogging, or plugging. All three Buell Systems are illustrated and described in "The Collection and Recovery of Industrial Dusts". Write for a copy to Dept. 12-J, Buell Engineering Company, Inc., 123 William St., New York 38, N. Y.



Experts at delivering Extra Efficiency in

DUST COLLECTION SYSTEMS

Pumps, Fans, Compressors

Compressor Air.....New 24-page bulletin describes the WN-112 stationary air compressor. Specifications, diagrams, installation photographs, etc. Range of 468-974 cfm.

278A Joy Mfg. Co.

npressors.....from vacuum to 15,-000 PSIG, 7½ to 5,000 horsepower. There are different types and classes available for every process need. *Chicago Pneumatic

.. Axial-flow & Cen-Compressors.. rifugal compressors can be designed to your specifications. Standard models are also available. Bulletin "Joy Turbodynamics."

109 *Joy Mfg. Co.

Compressors.....from single stage to six stages, from 125 to 25,000 psi pressure for gases as follows: Acetylene, Argon, Ethane, Helium, Nitrogen, Oxygen, etc. Catalog 44. 276 *Norwalk Company, Inc.

Compressors Centrifugal.....Informa-tion on equipment best suited to oyour compression requirements—centrifugal, reciprocating, axial-flow rotary or ejector.

Compressor, Screw.....features oil-free operation. Suction volumes 350 to 15,000 cfm. Compression ratios up to 1:4 for single stage & 1:10 for two-stage units. B289 *The Foram Corporation

np.....with hard rubber casing and impeller; Hastelloy C shaft. Offers faultless corrosion resist-ance. Information in Bulletin CE-55. 246c *American Hard Rubber Co.

Pumps.....Newly designed models are available to handle a wide variety of corrosive & viscous materials. Full information on new controlled capacity pumps is offered. No. 100. 266 *American Meter Co., Pump Div.

Pumps......Horizontal Triplex Pumps handle large volume of all types and densities of fluids. Cylinder can be disassembled in minutes. Bulletin P-55.

Pumps.....New bulletin entance
"Layne Propeller and Mixed Flow
Pumps" gives detailed
cutaway drawings,
tables and application data.

278B Layne & Bowler, Inc.

Pumps.....Aurora End-Suction Centrifugal pumps with capacities to 1800 G.P.M. & heads to 320 ft. are covered in Bul. 119-C. Applications include cooling towers, etc.

273 *N. Y. Air Brake Co., Aurora Pump.

Case Pumps..Bulletin 1000 gives complete information and performance curves for these pumps. Purchase price of pumps is low and operating costs low. 244 *Weinman Pumps Mfg. Co.

Pumps Submersible... .Detailed drawings plus information on the appli-cations of the manufacturer's sub-mersible pumps are included in Bulletin No. 202. 4 pages. 278C Layne & Bowler, Inc.

* From advertisement, this issue

Services & Miscellaneous

Catalytic Purifier.....is combined with an automatically operated drying unit to provide oxygen-free hydrogen that is ideally pure & dry. Descriptive literature offered. 14-15b "Engelhard Industries, Inc.

Construction experience plus pro-curement knowledge gained in construction of some 805 large and small plants throughout the world. Booklet available. 205 "Foster Wheeler Corporation

Drilling Machines.....used to drill into mains to make new connections & to add valves while the main is under pressure—without shutting off the flow of water or *Mueller Company

Fire Extinguishing System.....Carbon dioxide system features all operating parts completely enclosed to guard against fouling or accidental operation. Booklet. 268 *Walter Kidde & Co., Inc.

ot Plant.....Reprints of 4-pg. arti-cle which discusses factors to con-sider in deciding when to engage an outside firm to do pilot plant work & when to do it yourself. 28-29 *The Lummis Co. Pilot Plant ...

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Mixers: Baker Perkins double
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165 ctl. ft; Lightnin, ½
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- —Struthers Wells 2000 gal. 316 S.S. įktd. agtd. Reactors. —500 gal. Walters, 304 S.S. įktd. agtd. Reactor. —550 sq. ft. Buflovak, monel, single effect Evaporator. —7500 gal. 316 S.S. Vert. Storage Tank, 7′ x 25′ 50 PSI.

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- —12,000 gal. horiz. steel Pressure Tank, 7'6" x 36', 200 PSI —Stainless Heat Exchangers, 1220, 942, 786, 536, 396, 315, 250, 157 sa. ft.

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- —Sharples H2 Nozzlejector, 15 HP, 304 S.S. —Bird 40" suspended, 347 S.S. perforated basket.
- -Sharples #16, 304 S.S., 3 HP motor.

FILTERS

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 1—Sparkler 332528 Filter, 150 sq. ft. 304 S.S.
 1—Niagara 36H110 horizontal Filter, 110 sq. ft., 304 S.S.
 1—#12 Sweetland Filter, 48 leaves, 3" centers, 640 sq. ft.
 2—#10 Sweetland Filters, 27 leaves, 4" centers, 250 sq. ft.

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- -Traylor 30" x 18' Stainless Steel Rotary Dryer.
- 2-Link Belt; 7'5" x 25", 6'4" x 24' S.S. Louvre Dryers.

- 1-Baker Perkins #16TRM, 150 gal. jktd., Vac. 60 HP.

- —Buker Perkins #101km, 130 gdl. |ktd., Vac. 60 HP—Baker Perkins 100 gal. |ktd., Sigma Blades.
 —Day "Cincinnatus" double arm, 250 and 100 gal.
 —1500# Powder Mixers, 7½ HP XP motor.
 —Steel, |ktd. Powder Mixers: 225 and 350 cu. ft.

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- Link-Belt #604-18 roto-louvre dryer, 6'4" dig. x 18' long. dryer, 6'4" dia. x 18' long, w/cyclone, fans, etc.
- Link-Belt #310-20 roto-louvre dryer, 3'15" dia. x 20' long.

STOCK ITEMS

STAINLESS REACTORS—KETTLES

- 3-3500 gal. T316 SS, jkt. & agit.
- 2-2250 gal. T316 SS. jkt. & agit.
- 1—2200 gal. T316 SS. jkt. & agit., VAC.
- 1—1300 gal. T304 SS, jkt., 5 HP XP agit.
- 3-750 gal. T304 SS. jkt. & agit.
- 1-500 gal. T304 SS, jkt. & agit.
- 6-465 gal. T304L SS, jkt. & agit.
- 1-350 gal. T304 SS, ikt. & gait.
- 2-125 gal. T316 SS. iki.

ROTARY KILNS-DRYERS

- 1-11' x 155' Traylor, %" shell Kiln.
- 1-9' x 100' Vulcan, %" shell Kiln.
- 1-8' x 125' Kiln, %" shell.
- 1-8' x 115' %" shell, 2-tire Kiln.
- 2-7'6" x 100' 1/2" shell Kilns.
- 1-7'6" x 60' Kiln, 1/2" shell.
- 4-Hardinge 8'8" x 70' dryers, 5%"
- 1-7'6" x 60' dryer, 1/2" welded shell.
- 1-Allis-Chalmers 7' x 50' dryer., %".
- -6' x 50' Louisville dryer.
- Steel dryers: 5'6" x 50', 4'9" x 32', 4'6" x 40', 4' x 30', 3' x 15'.
- 2-Stainless dryers: 4'6" x 12', 3' x 10'.

- 1-8000 gal. T304 SS, vert.
- 12-4500 gal. nickel-clad, vert, 125#.
- 1-3000 gal. alum., vert., open.
- 1-10,500 gal., T304 SS, horiz., UN-USED, dished heads.
- 2-5700 gal. T304 SS, horiz., UNUSED.
- 4-Vacuum tanks w/coils, T304 SS: 3700, 3000, 2350, 1750 gal.
- 1-3400 gal. T304 SS, horiz.
- 1-2000 gal. T316 SS, hopper.
- 8—1750 gal. T304 SS, hoppers.

JUST PURCHASED

Kennedy 7' x 9' contin. ball mill. integral herringbone drive, 1948 -150 HP. Like New!

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- 2—1800 cu. ft. Read weight hoppers, T304 SS, 11'10" x 10'5" x 10'2", hopper bottom, fulcrums, scales avail,
- -Worthington 160 ton steam-jet vacuum refrigeration units.
- -10,000 gal. alum. cone-bottom tanks, 12' x 31' OAH. Buffalo T316 SS Blowers, 2330 cfm, 60 HP.
- American T316 SS blowers, 5600 cfm, 50 HP.

CENT.—FILTERS—CRYSTALLIZERS

- 2—Sharples #16-P Pressurtite, T304 SS. 2—Sharples C-20 Super-D-Hydrators, T316 SS.

- -Alco 110 sq. ft. pressure leaf filter, T316 SS.
 -Struthers-Wells vacuum crystalizers, 1200, 560 gal., T 316 SS, cone bottoms.
 -Eimco T304 SS rotary vac. filter, 18" dia. x 24" face.

EXCHANGERS—CONDENSERS—COOLERS

- 12—800 sq. ft. T316 SS heat exchangers, removable bundle.
- 75-T316 tubular heat exchangers & condensers, 2000, 1450, 880, 800, 750, 600, 530, 427, 400, 300, 264, 250, 235, 200, 185, 165, 150, 125, 64, 50, 47, 30 sq. ft.
- Copper & Cupro-Nickel heat exchangers & condensers, up to 1070 sq. ft.

TYPE 316 SS KETTLES

- 2—3,500 gal. Struthers-Wells vert., 7' dia. x 12' high, jacketed, int. coils, 40/20 HP agit.
- 1—2,830 gal. horiz. still kettle, 6' x 12' 100 sq. ft. int. coil.
- -2,250 gal. vert., 7' dla. x 6'3" high, jacketed, 3 HP agit.
- -2,200 gal., 6'6" x 8', vacuum jacketed, agit, T316 SS.

TYPE 316 STAINLESS STEEL TANKS

- -17.650 gal. horiz., 9' dia. x 36' long, ¼" shell, ¾" dished heads.

- 1—1,755 gal. horiz., 6' x 12'. 5/16 shell & dished heads, VACUUM.
 3—2,750 gal. vert., 7' x 8', dished heads, int. coils.
 9—2,300 gal. vert., 7' x 8', int. coils, (some w/agit).
 5—2,250 gal. vert., 7' x 6'3", dished heads, (some w/agit, some w/jacket).
- 1.900 gal. vert., 5' x 8', 36" shell & dished heads, VACUUM. -1.200 gal, vert., 5' x 7', dished top, cone bot., VACUUM. -885 gal. vert., 3' x 13', internal coils.

- -575 gal. vert., 4' x 6', dished heads, int. coil. -580 gal. vert., 3'6" x 7', dish top, cone bot., VACUUM.
- 50-Tanks & pots, 30 to 500 gal., T316 SS.

COLUMNS—STAINLESS STEEL

- 1-110" dia. Vulcan, 10 trays-bubble caps, T316 SS. 2—96" dia. Vulcan, 30 trays—bubble
- caps, T316 SS. -96" dia, Vulvan, 10 trays—bubble
- caps, T316 SS.
- -60" dia. Vulcan, 10 trays—bubble caps, T316 SS.
- 1—48" dia. Vulvan, 25 trays—bubble caps, T304 ELC SS, 100 PSI. 3-24" dia. Vulcan, 12 trays-
- caps, T316 SS-VACUUM. 6—T316 SS Packed Columns: 42", 36", 30", 24", 20" dia.
- Steel Packed Columns: 60", 48", 36", 30". 20".

COLUMNS-COPPER

5—Vulcan copper bubble-cap columns. VACUUM! 72" x 40 plate: 48" x 25 plate: 48" x 22 plate; 24" x 20 plate.

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MISCELLANEOUS EQUIP.

- 2000-T316 SS flanged valves, globe or
- gate, ½", 1", 1½" up to 12".

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 5, sixes ½", 1", 1½", 2" up to 12".

 50—T316 SS pumps, sixes from 6" x 5"
- to 1" x 1". Otis elec. freight elevator, 5000# capacity @ 75 FPM.
- Stainless steel reboilers.
- Stainless steel bucket elevators, 60' & 40' high.
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-Stokes Model T tablet press -18,000 gal. Stainless steel horizontal storage tank, 60

psi Stokes Model 138-J-20 wingle door vacuum shelf dryer,

20 shelves, complete
-Lightnin "MIXCO" 50 HP drive Model 413-TELS-502 complete with stainless steel agitator

AUTOCLAVES, KETTLES AND REACTORS

-Alco type 316 SS jacketed reactors, 3000 gal.

- Allied Steel Products type 316 SS jacketed reactor, 750 gal.
- Edgemoor Iron Works type 316 SS jacketed reactor, 750 gal.

Type 316 SS 600 gal. jacketed kettles

- Buflovak SS 300 gal. jacketed reactor
- Plaudler type 316 SS 150 gal. jacketed reactor, complete with agitator and drive
- Steel & Alloy Tank Co. 125 gal. type 347 SS jacketed autoclave, 250 psi jacket and internal
- Steel & Alloy Tank Co. 100 gal. type 347 SS pressure tank. 250 psi jacket
- Blaw-Knox 400 gal, steel jacketed autoclave, 570# internal pressure, 85# jacket
- Blaw Knox 45 gal. jacketed autoclave, 1500# pressure
- Plaudler 500 gal. glass lined reactor, complete with anchor type agitator and drive
- Plaudler Series R 500 gal. glass lined jacketed reactors, complete with impeller type agitators, baffles and drives
- Struthers Wells 500 gal. nickel jacketed reactors
- -Patterson-Kelley 6000 gal. steel jacketed reactor, 40# jacket. complete with agitator and drive
- Patterson 2000 gal, steel jacketed reactor
- 28-30,000 gal. steel vertical storage tanks

DRYERS

- 1-Link Belt Steel roto louver dryer, Model 1003-30
- –Link Belt steel roto louver dryers, Model 207-10, 310-16, 604-20 –Buflovak double drum dryer 42" x 120"

- J. P. Devine single door vacuum shelf dryers, 20, 17 and 12
- Stokes Model 59DS steel rotary vacuum dryer, 5' x 30'

Stokes double drum dryer, 5' x 12'

- Louisville rotary steam tube dryer, 8' x 45'
- Louisville SS rotary dryers, 8' x 50'

 Louisville SS rotary kiln, 30" x 28', complete
- Lousville rotary dryer, 38" x 40', Type L Ruggles Coles 4' x 30' rotary kiln -Traylor 4' x 40' rotary dryer
- Swenson 10' dia. spray dryer
- -Rotary dryer, 6' x 36'

FILTERS

- 3-Dorrco rubber covered filters, 6' x 2'
- -Sweetland #3 stainless steel filter
- -Feinc SS rotary vacuum string filter, 3' x 3' (NEW) -Niagara SS filter, Model 510-28 -Niagara SS filter, Model 36H-110-3

- Oliver horizontal filter, 3'
- Oliver SS rotary vacuum pressure precoat filters, 5'3" x 8'. complete
- -Shriver plate and frame filter presses, 12" to 42"
- Shriver rubber lined filter press, 36" x 36"
- 12—Sweetland #12 Filters with 72 SS leaves

CENTRIFUGES

- 1—Tolhurst SS 20" suspended type centrifuge with perforated basket, complete with motor and plow
- -AT&M 26" suspended type centrifuge with SS perforated basket, complete with motor and plow
 -AT&M 48" SS suspended type centrifuge complete with plow,
- motor and imperforated basket
- Sharples type 316 SS Super-D-Hydrator, Model C-20 Sharples type 316 SS Super-D-Canter
- Bird type 316 SS centrifuge 32" x 50"
- Tolhurst 30" center slung rubber covered centrifuges with perforgted baskets and motors



CHEMICAL **PROCESS** EQUIPMENT

> THE GELB GIRL OCTOBER 1959



MIXERS

- 3—Robinson type 316 SS sigma type jacketed heavy duty mixers. 400 gal.
- Baker Perkins double arm sigma blade mixers, 100 gal. Baker Perkins 50 gal. double arm sigma blade jacketed mixer,
- Size 8, Type CE

12' x 4' type 316 SS pug mixer

Sturtevant #7 dustless type rotary batch blenders (NEW)
-Munson rotary blender, 40 cu. ft.
-Patterson type 347 SS jacketed vacuum sigma kneader master, 500 gal.

MISCELLANEOUS

- 1—Cleaver Brooks 500 HP package steam generator, 200#
- Ames 300 HP package steam generator, 150# -Cleaver-Brooks pack, steam generators, 50 & 80 HP. 125#
- Heat Transfer Products steel bubble cap columns, 36" and 42" with 5 and 10 trays
- Acme steel bubble cap column, 42" dia. with 10 trays
- Patterson-Kelley steel heat exchangers, 1000 sq. ft. each Struthers Wells heat exchangers, 885 sq. ft.
- Patterson-Kelley steel heat exchanger, 427 sq. ft. Steel heat exchangers from 15 sq. ft. to 400 sq. ft.
- Davis Engineering SS heat exchangers, 145 sq. ft. and 230 sq. ft. (NEW)
 - Struthers Wells type 316 SS heat exchanger, 330 sq. ft.

 - -Struthers Wells type 316 SS heat exchanger, 330 sq. ft.
 -Condenser Service type 316 SS heat exchangers, 350 sq. ft.
 -Badger type 316 SS heat exchangers, 500 sq. ft. and 600 sq. ft.
 -Badger type 316 SS bubble cap column, 42" dia. with 11 trays
 -Badger type 316 SS bubble cap column, 36" dia. with 8 trays
 -Vulcan SS bubble cap column, 4' x 28 plates
 -Robins shaker screens, SS, 3' x 6"
- Swenson type 316 SS vacuum crystallizer, 3'6" x 12'
- Swenson type 316 SS vacuum crystallizer, 2' x 12'
 -Blaw Knox steel distillation col., 36" x 40' with 24 trays (NEW)
 -Williams type 316 SS hammermills, Model AK

- -Stokes stainless steel rotary vacuum dryer, 2' x 6'
 -Industrial stainless steel jacketed vacuum double cone
 blender, 12 cu. ft., complete
 -Baker Perkins size 16 Type UUEM 150 gal. jacketed
 double arm dispersion mixer, complete with compression cover and 100 HP motor
 -Products type 316 SS jacketed reactor, 700 gal.

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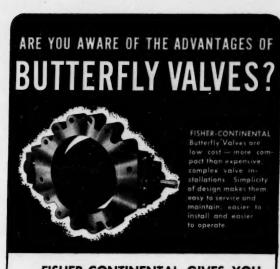




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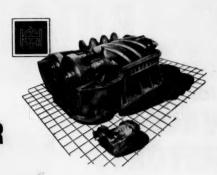


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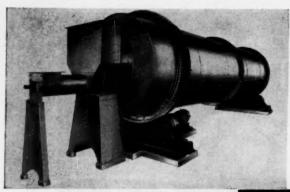
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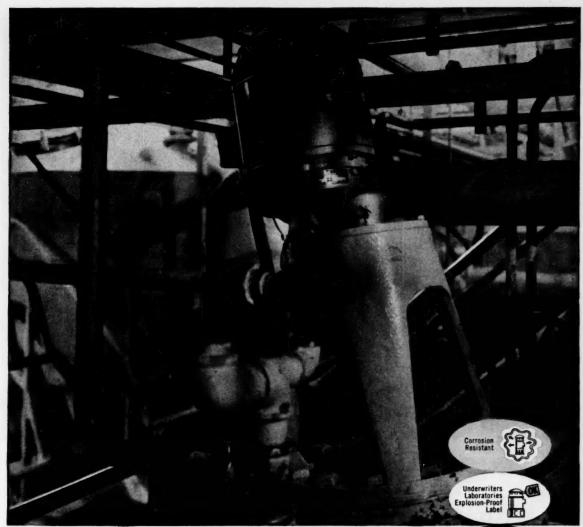
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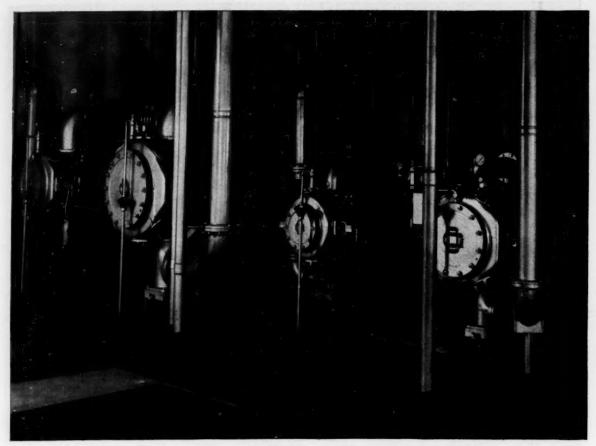
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New Gardner-Denver HAF compressor (left) now supplies all air for a large plant. HAC (right) was retained as a stand-by unit.

How to modernize your plant with a planned compressed air system



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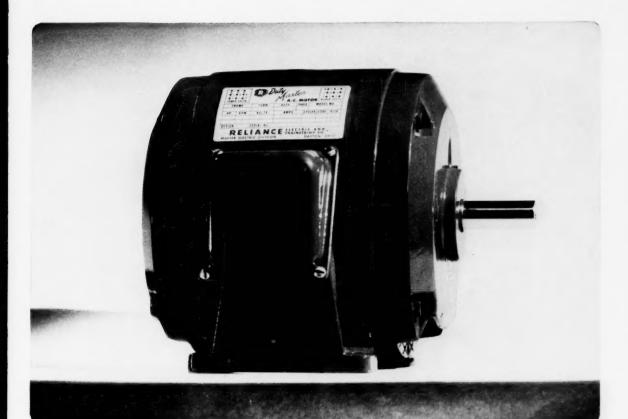


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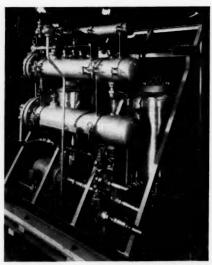
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